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London Railways

IF our railway system were being laid down to-day steam locomotives would not be used. We have, however, to deal with things as they are, and in this respect the economic side of railway electrification is akin to that of substituting supply from the public mains for local industrial plants, *i.e.*, the capital charges plus the running costs of the one have to be lower than the running costs only of the other. The case for main-line electrification rests largely upon such a comparison, which is directly related to traffic density, usually expressed in trailing ton-miles per track-mile per annum.

In urban and suburban areas, the more obvious economic aspects count for less than do the advantages peculiar to electrification; *e.g.*, rapid acceleration resulting in the ability to run a greater number of trains over a route within a given time, cleanliness and absence of fumes in tunnels. These have a value over and above that provided by the present-cost balance, which may be struck on an average at the relatively low density of 3.5 million ton-miles.

Regarding the proposals of the London Passenger Transport Board, particulars of which we gave last week, the issue is not now complicated by a "battle of the systems." The technical features were settled by the Pringle Committee in 1927, and the only outstanding question is that of the d.c. voltage to be employed, having regard to previous circumstances. The standard overhead system of 1,500 V would be unsuitable for lines required to make a through running connection with the existing 600-V three- and four-rail systems, but it would presumably be applicable to the Edgware-High Barnet-Alexandra Park and the Loughton-Shenfield services.

While the close spacing of the railway stations makes the voltage question one of secondary importance for immediate purposes, the radiating lines will no doubt be extended with an ever-increasing density of traffic. However, the Southern Railway (which officially opens the Eastbourne-Hastings electrified section next month and is also considering changing over some seventy miles of main line to Portsmouth) manages well with a 650-V third-rail track associated with 33-kV a.c. transmission to the sub-stations where necessary. We may assume that rectifiers, which have proved their worth in units up to 1,500 kW at 1,500 V (on the L.M.S. Altrincham line) and 2,500 kW at 650 V (on the Southern Railway), will be employed, many of them in remotely controlled sub-stations.

It will be some time before the new schemes can be completed. This should permit the requisite reorganisation to be effected which, together with the better train schedules, will avoid displacement of labour.

The proposals of the Transport Board, good as they are, are very far from meeting the immediate needs for railway electrification round London which are outside its jurisdiction. We have heard Essex seriously mentioned as desirable for a quiet rural retreat in view of the non-electrification attitude of the L. & N.E.R. This attitude will doubtless yield to the logic of events. If full electrification in that county must await the growth of local populations whose work takes them to London, the Diesel-electric system provides a sound method of developing the passenger traffic up to the point at which its density reaches, say, two million ton-miles per annum.

A Million More

THE Electrical Development Association has in view a campaign for the coming autumn and winter seasons carrying on into the spring of 1936. It may be described as the 1935-36 Campaign for a million more consumers. The Publicity Committee will shortly have artists' drawings and advertising agencies' recommendations before it, and it is expected that early in July the full programme will be ready. As at present contemplated it will consist of not less than nine months' Press publicity. It

is to be the biggest E.D.A. effort, and it will be supported by additions to the sales personnel of electricity supply undertakings. We hope that this combination of publicity and actual canvassing for new consumers will be found possible, for if carried out with energy and foresight it should be effective in accelerating the rate of new connections which is what everybody ought to want. The plan might be made to assume the proportions of a national canvass such as has been recommended in these pages on many occasions. Committees and engineers should begin to make arrangements immediately the scheme comes before them. If preparation of details and new staff appointments are deferred until after the summer vacation local action in the autumn is almost certain to be delayed.

Voltage Variations

WHILE the variation from the voltage declared at consumers' terminals permitted by the Commissioners' regulations is six per cent. up and down, a drop in voltage has a more pronounced effect than a rise, since it must be added to the drop in the consumers' own wiring, the limit to which is set by the I.E.E. Regulations at 2½ per cent. (at 230 V). A report of the Electrical Research Association published in the Journal of the Institution of Electrical Engineers for June suggests that the 6 per cent. Commissioner's limits would have been better at +7½ per cent. and −4½ per cent. This seems sound, as it is the condition at the consumers' apparatus that is the important thing. The multiplicity of distribution voltages in use is responsible for a " sales " tolerance of an additional 5 per cent. and manufacturing exigencies for a further 5 per cent. each way, but all tolerances are not likely to be fully operative at the same time. The report contains, in addition to much other useful information, the results of investigations into the effects of over- and under-voltage on the efficiency and life of apparatus. Thus a kettle may take half as long again to boil water with the voltage 16 per cent. low, and a fire element will have only half its proper life with the voltage consistently 6 per cent. too high. The moral is to use more automatic voltage regulators.

Television

IN commenting on the Selsdon report on television on February 8th, we pointed out that a full service throughout the country could not be expected for some years ahead, even allowing for the rapid developments in technique that might reasonably be expected. Potential " lookers-in " are likely to be disappointed if, as a result of the official choice of the Alexandra Palace as the first television transmitting station, they expect results in the near future comparable in quality with those now provided by sound broadcasting, and at anything like the same low cost for receiving sets. In any case, it would be a mistake to regard television as an alternative to sound broadcasting. It is rather a supplementary form of entertainment, and as it calls for sustained attention on the part of those concerned, it cannot, like music, provide a background for other pursuits. Moreover, television programmes are to be transmitted on ultra-short waves, whereas sound broadcasting will continue to be carried out on medium and long waves, for which the B.B.C. is proposing to erect four new stations of the existing type. Therefore, as our readers will appreciate, television will not take the place of radio reception as now understood.

American Electrical Hopes

DURING the protracted period of depression in America, with all its problems under the N.R.A. code, there has been no standing still on the part of electrical manufacturers. Both in the improvement of existing designs and in the production of entirely new ones progress has been taking place. Business policies and organisation systems too have been investigated and improved, and so the electrical world is now ready with more efficient and useful products for the market and a reformed organisation for marketing them. Such at least is what we gather from a recent editorial in the *Electrical World*, which reminds its readers, though by this time we fancy every electrical engineer should know it quite well, that " the electrical industry never ceases to go forward . . . . it could not do otherwise if it wished." We ourselves always feel that with the big margin of electrical undevelopment existing in most countries there is much to gain by giving things a good united push, but that merely by the way. Our contemporary holds that the depression has been but a breathing period in the business marts, permitting the electrical industry to re-arm itself. It seems to be felt that there is no need for any more expensive campaigns to make the public electrically-minded—the chief need is for electrical articles that will sell easily, and these it is said are now available. Noting the signs of improvement in commercial affairs one writer sees electrical men taking their " new bombs "—the result of technological research and invention—out into industry and blasting " the *status quo* into oblivion " so that the people may have and use these new and better and cheaper things. If optimism will help, then our transatlantic cousins are likely to win!

Ethereal Transmission

THE transmission of electric power without wires is often suggested as a possibility of the future, but it seems to have been accomplished in Czechoslovakia recently. A reader sends us a cutting from a daily paper announcing the invention of a clock in Prague which is operated by impulses received from a distance of as much as 500 miles. It is said to be simple and cheap to construct and " uses at the most five kilowatts of electric current an hour." From this to radio-electric cooking is but a small step!

Record Progress

AMONG the many satisfactory features of the General Electric Co.'s report, printed in our " City Notes " section (p. 927), is the all-round character of the improvement which has led to the advance in profit by £213,000. There has been better business both at home and in the export markets, and the benefit has been spread over both heavy engineering work and general electrical supplies. It is some time since both markets and both classes of work expanded simultaneously. In some departments additions to productive capacity as well as at Kingsway have had to be made, and the number of employés has advanced by 5,733 to close upon 30,000. But let the reader examine the directors' statement for himself, and study in conjunction with it our analysis of the excellent electrical export trade figures for the month of May, appearing on page 913. Industrial revival at home, export progress, electricity supply expansion, and railway electrification all promise good business.

" Dumped " Electricity

THE reality of the benefits to be derived from the sale of off-peak energy at very low rates is questioned in our " Correspondence " columns this week. The implication that a small net surplus, even if insufficient to allow of a reduction in price to other consumers, is of no account will not, we think, meet with general acceptance. Moreover, a consumer is entitled to expect a tariff low enough, so far as may be practicable, to enable him to use electricity instead of some less convenient means of carrying on his work. This is quite apart from the effect of the connection on other consumers, the assumed surplus implying that they are not adversely affected. Experience supports the claim advanced in the " Industrial Power Supply " paper read at the National Convention that large supplies which improve the load factor bring advantages to an undertaking that cannot readily be expressed in terms of cost. Among the chief of these we should place the hastening of the day when larger and more modern plant will be installed. Then the consequent reduction in costs would secure lower charges to all.

Lansdowne House Club

Features of the 2,000-kW electrical installation

WITH a total loading of over 2,000 kW, the electrical installation at the new Lansdowne House Club, Berkeley Square, London, can probably claim to be the largest of its kind in the country.

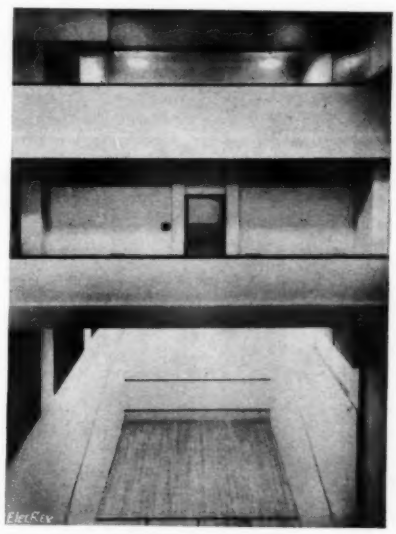
The preservation of the Adam ceilings and numerous other unique architectural features of the old Lansdowne House, which forms the major portion of the club premises, have made the installation one of exceptional difficulty, and the way in which the Bective Electrical Co., Ltd., the electrical contractors, and Messrs. James Combe & Son, Ltd., the heating and ventilating engineers, have arranged the plant and equipment—not to mention over forty-five miles of cable and twelve miles of conduit—really merits an article to itself. In the space at our disposal we can, however, hope to do little more than enumerate a few of the outstanding features of the installation.

Left: Main baking oven. Centre: Extraction fans on roof. Right: Main switchgear

In the Club's own sub-station the electricity supply from the Westminster Electric Supply Corporation, Ltd., is stepped down from 6,000 to 600 V by three 500-kW air-cooled Hackbridge transformers and passes to the main Johnson & Phillips switchboard for distribution. An alternative supply is available for lighting from another of the supply company's sub-stations nearby. The main l.v. switchboard was supplied by the General Electric Co., Ltd.

The architecture of the building offers innumerable opportunities for beautiful lighting effects—a fact which the Bective Co., in conjunction with the architect, Mr. C. W. Fox, has not overlooked in designing the fittings. In the ball-room two inverted pedestal lamps fixed on to balcony rails at each end of the room illuminate a fine ceiling, while incorporated in the rich walls are eight concealed three-colour fittings remotely controlled by motor-driven dimmers (Venreco). In addition, there are four magnificent candelabras and a spot-light.

A special system of shadowless lighting has been installed in the main card room, the whole of the illumination coming from flush ceiling units of unusual design. Two massive indirect standard fittings and lights over the mirrors give the smoking room an atmosphere of comfort, and about a thousand lamps are used for the concealed cornice lighting in the dining-room. We cannot leave the lighting installations of the more decorative type without mentioning the swimming bath where, in addition to fourteen pedestal fittings on the balcony rails, an attractive concealed lighting system is embodied in rectangular plaques under the balcony.



The squash court

The laylights in the main squash court provide illumination comparable with bright sunlight and the resident professional tells us that it is the best-lighted court he has played on. Over the seating accommodation for spectators a number of attractive fittings of the tubular type have been placed. The other three squash courts are illuminated by the more usual reflector-type lamps.

The Thermal Storage Plant

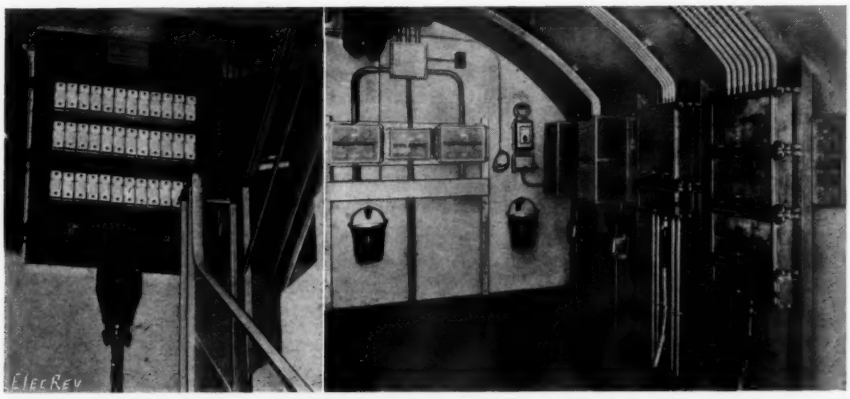
Perhaps the most interesting part of the building, electrically, is the thermal-storage and air-conditioning installation. The heating of the whole building, the complete hot water service, and the air-conditioning plant, are dependent on three Bastian and Allen 600-kW electrode boilers, it being possible to switch on one, two or three as required. The system is thermostatically controlled and the boiler control panel, besides being equipped with time-switches and automatic load control, has a distance thermometer (Foster Instrument Co.) showing the temperature in all the main rooms of the building as well as that of the water in the various storage cylinders and the swimming pool. Callender's "Arcalite" heavy cable is used for the connections to the boilers, etc.

From the boilers Pulsometer primary pumps driven by 2-h.p. Bull "Super-silent" motors convey the water to two vertical 8,000-gal. thermal storage cylinders, while secondary pumps supply two horizontal 6,000-gal. hot water service storage calorifiers, whence in turn pumps deliver the water required for wash-basins, baths and hot towel rails. In each case the pumps are installed in duplicate. The water from the thermal storage cylinders when used for heating is mixed with the water in the heating system by an automatic three-way modulator valve which maintains a constant and predetermined floor temperature.

Although the building generally is heated by radiators on the hot water system, a number of rooms, including the ballroom, dining-room, squash courts, swimming and Turkish baths, and the ladies' and gentlemen's hairdressing saloons, rely, either entirely or partly, on conditioned air for their warmth. The air-conditioning plant comprises an air-washer (James Keith and Blackman Co., Ltd.) which cleans, humidifies, warms or cools the air as required, the air heaters being served by water pumped from the thermal storage cylinders. Incorporated in the air-washer are a preheater and a main heater, both of which are automatically controlled to give the required temperature and humidity in the main public rooms. In addition, booster heaters are fitted on each separate circuit, these also being thermostatically controlled. The fan motor control gear (Airedale Electrical Manufacturing Co.) is arranged for 50 per cent. speed regulation.

The conditioned air enters the rooms generally through perforated cornices or plaques in the ceiling and is extracted through inconspicuous grilles (usually in the walls) by fans on the roof of the building. The Turkish baths are supplied with hot air from the main air-conditioning plant and then

boosted up by 5-kW Bastian and Allen heaters, one being in each room. There is a separate supply and extraction plant complete with viscous air filter serving the gymnasium and swimming pool, and a further extraction plant serves the billiards room, card rooms, &c.



One of the special 3-phase 400-V fuse boards and a corner of the main l.v. switchroom

The swimming pool has a heating installation of its own comprising a 100-kW electrode boiler (operating load 60 kW) of a type similar to those employed in the thermal-storage plant. The electro-katadyn process of sterilisation (Candy Filter Co.) ensures absolute cleanliness of the water. The Turkish baths and the hairdressing saloons are all-electric. All the fittings in the gymnasium have been designed to give it the appearance of a ship's deck.

In addition to a main central kitchen the Club boasts no fewer than ten remote service kitchens, each of which (with the exception of the main range) is all-electric. The cooking equipment (Carron Company) includes electric ranges, hot-cupboards, fish-grills, steaming ovens, bains maries, and water, milk and coffee boilers. "Ellarcold" refrigerators were supplied by the Lightfoot Co. Callender's special heat resisting cable is used throughout the kitchens.

Among a host of other electrical equipment installed in the building are: Lifts (Waygood-Otis), clocks (Gent & Co.), central vacuum cleaner plant (Sturtevant), "Telematic" automatic telephones, and a Phœnix luminous call system. Sixty motors ranging from ½ to 20 h.p. are used.

Welding Fine Wires

THE essential features of a new method of welding wires developed at the Institute for Heavy Current and High Voltage Technology of the Technische Hochschule, Dresden, consist in the use of an aperiodic discharge from a static condenser, and in the use of a preliminary discharge to form knobs on the ends of the wires which are then fused together by the welding discharge, forming a reinforced joint. The method has been applied successfully to wires of copper, iron, aluminium, constantan, nickelin and nichrome, and is recommended as a reliable and economical means of making permanent connections between small wires in the mass production of resistances, thermo-couples, heating elements, and similar items.

The accompanying data, given by O. Zdralek and J. Wrana in *Elektrotechnische Zeitschrift*, were obtained from an experimental equipment arranged as shown in fig. 1. Dry-electrolytic condensers were used, weighing only about 4 grm. (0.141 oz.) per μF and occupying 4 cu. cm. (0.244 cu. in.) per μF. The wires to be welded, from 0.1 to 0.5 mm. (0.0039-0.0197 in.) in diameter, were held by spring clips and brought together by hand. Tests were first made with periodic discharges, using an ironless choking coil in the discharge circuit, but it was found that the welds were then irregular in quality, bad joints being often obtained under conditions which had previously been satisfactory. Oscillograph records showed that the spark was often extinguished when the current passed through zero. Also, with too much welding energy, molten metal was driven away from the ends of the wires and formed knobs on the sides.

Good results were, however, obtained when ohmic resistance was used instead of a choking coil to adjust the welding period, and the discharge was aperiodic or non-oscillatory. The most favourable time-constant of the discharge was about 10^{-3} sec. for all the sizes of wires, 0.1-0.5 mm. (0.0039-0.0197 in.), only the discharge energy needing to be adjusted to the cross section. This was done most conveniently by keeping the capacity constant and varying the condenser voltage by means of the potential divider. Using a capacity of 775 μF and a resistance of 1.3 ohms, the best voltages were as shown in the table for direct (*i.e.*, single-operation) welding. No welding could be effected below 30 V, hence for wires smaller than 0.1 mm. (0.0039 in.) a smaller capacity and a voltage exceeding 30 V must be used.

The reason for this is clear from fig. 2, which shows that the voltage falls to about 30 V directly the wires come in contact and remains at this value for a time (fig. 2a), falling suddenly to zero at the moment when the weld occurs; at this instant the current rises momentarily, as shown in fig. 2b. A perceptible difference between the amounts of metal melted at the ends of the two wires (more on the positive pole) confirms the conclusion that the action is a form of arc welding, and is therefore accompanied by greater heating of the wires than that produced by contact resistance in resistance welding.

Compensating for "Necking"

Direct single-operation welding by the above process often results in a "necking" or reduction in section of the wire at each side of the joint, probably by pinch effect. On increasing the applied energy the molten metal forms knobs which remain at the ends of the wires, thus affording a means of compensating for the "necking" tendency and building a reinforced weld.

The complete operation of welding must be carried out in two stages: (1) The wires are first brought together with the condenser charged to about 20 per cent. higher voltage than that used for direct welding (see "Ball forming" columns in the table). This results inthe formation of a ball of metal on the end of each wire. (2) The ball-ends of the wires are brought together, with the condenser charged to about 10 per cent. higher voltage. This further increase in voltage is necessary because of the increased section of metal. The energy of the discharge is in such relation to the mass of metal that an excellent weld is produced. Reliable joints are obtained between wires of iron, aluminium, constantan, nickelin and nichrome; also between iron and copper, constantan and copper, aluminium and copper, and between wires of different sections (1:16). Only in the case of aluminium is it preferable to eliminate the preliminary ball-forming operation and weld by a single application of the voltages stated in the table, with the wires in crossed instead of butt contact.

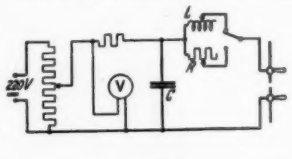


Fig. 1

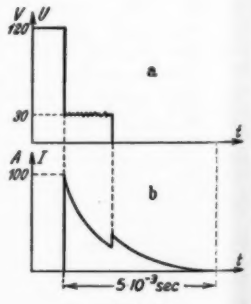
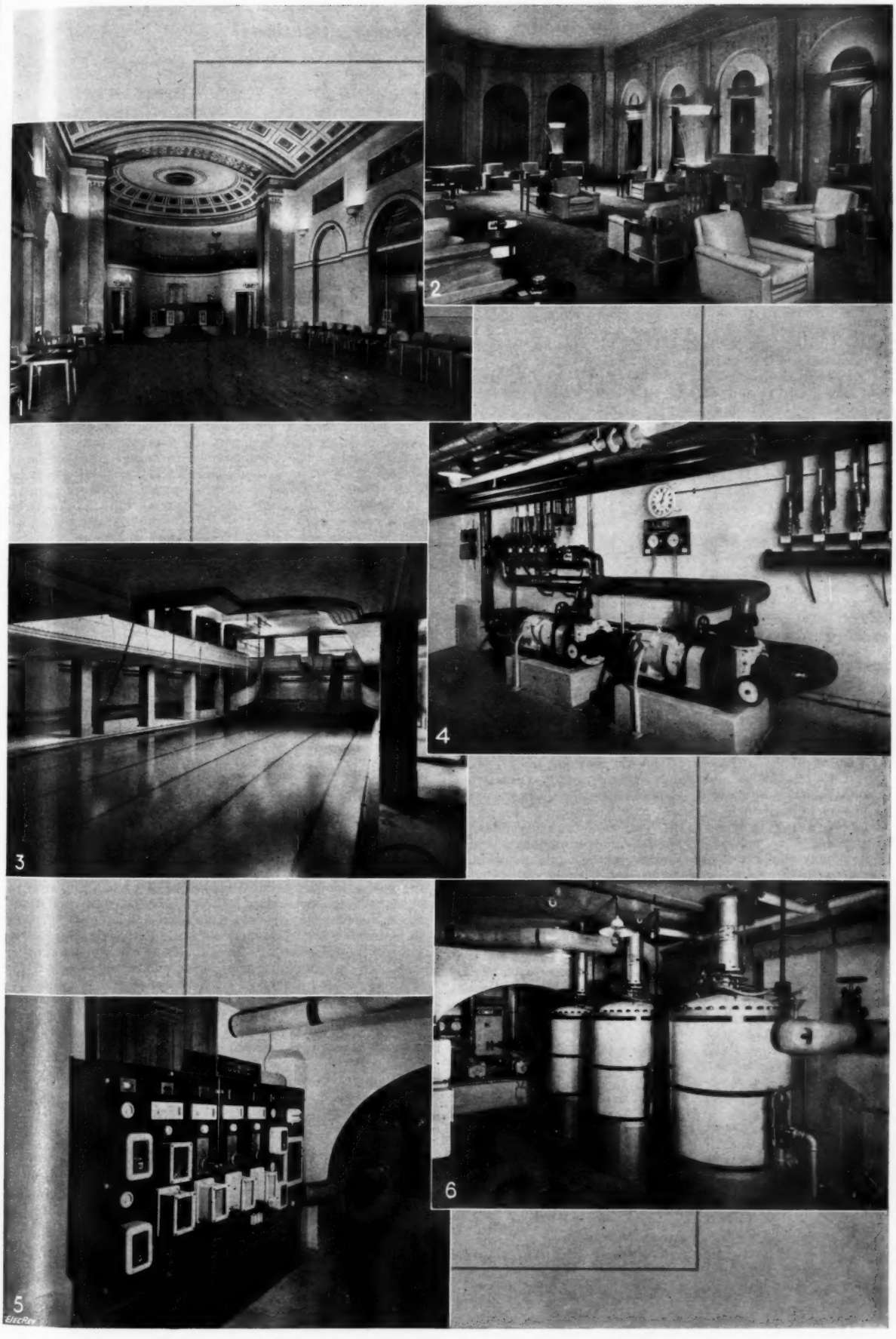


Fig. 2

VOLTAGE VALUES FOR CONDENSER WELDING OF WIRES WITH C = 775μF. AND R = 1.3 OHMS.

Dia. of wire.		Copper.		Iron.		Constantan.		Nickelin.		Aluminium.
mm.	in.	Direct welding.	Ball forming.*	Direct welding.	Ball forming.*	Direct welding.	Ball forming.*	Direct welding.	Ball forming.*	Direct welding.
		V.	V.	V.	V.	V.	V.	V.	V.	V.
0.1	.0039	—	40	40	50	—	40	—	—	—
0.2	.0078	65	80	70	90	65	85	60	70	50
0.3	.0118	100	130	120	140	90	120	90	120	90
0.4	.0157	150	200	160	210	145	185	150	190	110
0.5	.0197	200	—	210	—	195	210	200	—	130

* 10 per cent. higher voltage is required in the subsequent actual welding discharge.



The Installation at the Lansdowne House Club (See page 897)

1. The ballroom. 2. The smoking room. 3. Swimming pool, showing conditioned air inlets. 4. Hot water service pumps. 5. Boiler control panel and distance thermometer. 6. Electrode boilers.

Power Station Efficiency. By D. Shipton Wood, A.M.I.E.E.

Points which should receive attention

MUCH is heard in these days about the overall efficiency of the so-called "super station" by which is meant a generating station rather larger than the average, with a comparatively high overall thermal efficiency but not necessarily correspondingly low production costs.

With the coming of the grid, the consequent closing down of small stations and the enlarging of selected base-load stations, size is beginning to take second place. In time, doubtless, those with the higher efficiencies will be looked upon as the super stations, merely because with their good loading conditions and modern plant they achieve over 20 per cent. thermal efficiency, whereas the results obtained at the older stations with lower efficiencies may be far more creditable.

The credit for high efficiencies is usually due to the designers of the plant rather than to the operating staff, particularly in the turbine room. In the boiler house more depends on the owners, and efficiency and costs are largely wrapped up in the purchase and combustion of the fuel, the first of which is often outside the generating staff's jurisdiction.

Owners do not customarily publish their boiler-house results, but taking into account the class of fuel they sometimes burn, one may feel inclined to congratulate the turbine manufacturers.

The Stoker's Responsibility

In visits to various generating stations I have closely examined the fires, and have thought that it is the makers of the boilers and mechanical stokers who should take the credit for low costs. Firing appears to be left very much to the firemen, who have to carry on along the broad lines of basic principles that have been laid down for them. Are we not apt to forget that a so-called stoker no longer works with his hands, but with his head? Those in charge of the actual handling of the boiler units need not be technicians, but they should be men of the superior working class who can be taught what combustion means and how to carry out their engineer's orders intelligently; they should be encouraged to take a lively interest in firing, and be made to believe that the station fuel costs depend very largely on their efforts.

Firemen are not "stokers" nowadays; they are boiler-house attendants and have onerous responsibilities. Indeed, their importance cannot be over-estimated, particularly in stations where they are the shift charge engineers' only assistants in the boiler house.

Turning to the engineering staff, are they not too prone to fire just as the stoker makers advise, forgetting that the latter cannot know the operating conditions or the fuels burned? The way to burn these fuels can only be arrived at by actual trial over a lengthy period. Most stations burn many different fuels, mixed or married; some are slow-reactionary, while others are quick-reactionary; some caking, others coking; some swelling, others non-swelling; some porous, others non-porous. The marrying of fuels often changes their characteristics and fuels should be selected of types that, when married, have the best characteristics for efficient combustion.

Grate temperatures are much affected by the rate of burning, *i.e.*, with quick- or slow-reactionary fuels, also by the use of over-air, and by the percentage of ash in a fuel and its fusion point. Owners advertise for, and purchase, fuels often without any thought of all these conditions, placing the operating engineers in a difficult position, but much more could be done by the running staff.

The efficiency that should be definitely obtainable at any station cannot be laid down, as it depends on so many factors. Low cost is the primary object; paying a high price for a fuel merely to get a high efficiency is not business. One must first purchase fuel at a favourable price, and then get the highest possible efficiency.

Combustion Knowledge Essential

Generally speaking, owners are afraid to spend too much on combustion engineers, the boiler house too often being left to the shift charge engineers with only the boiler house foreman to assist them; they, themselves, cannot concentrate on their boiler house. Firing means team work, the members of the team being trained to work together under a captain who is on the field with them all the time, not one who can only spend odd moments directing them. Again, when undertakings appoint their station engineers, from resident engineers downwards, they seldom inquire closely into the combustion experience of the applicants, placing more importance on their works' training, electrical and mechanical. This is sound enough if specialists are to be appointed to assist in the boiler house; otherwise, provided a man is a good electrical and mechanical engineer, what really matters is his ability to obtain low fuel costs, as, generally speaking, the boiler house is where costs are made. A laboratory is of the utmost importance, and the chemists' must work in close harmony with the combustion engineers.

Importance of Correct Figures

Too much importance cannot be placed on the keeping of strictly accurate figures. To mention one point only, much depends on the correct sampling, correct determination of the calorific value, and correct weight of fuel; some stations weigh as received, and determine the calorific value from the fuel as fired after the addition of some 5 per cent. moisture, which is very helpful in obtaining a high efficiency, but not so in lowering fuel costs.

In all generating stations fuel appears to be fired in much the same way, provided the mechanical stokers are similar; that is, on the lines recommended by the makers, irrespective of the class of fuel burned. Stokers have improved, and consequently fuel costs have improved, too. Were a little individuality exercised by station engineers in endeavouring to improve on the makers' basic principles to suit their own fuels and conditions, fuel costs would drop still further.

The conditions of operation at selected stations under the grid should help to lower costs, but only if owners fully realise what an important part the purchase and combustion of fuel means, *and* if station men carry out many and continuous trials of fuels and firing. One cannot theorise on firing. There is a vast difference between combustion in the laboratory and in the boiler house. One cannot be without the former, which is helpful in determining the trials that are called for in practice on the actual grates. Also, proximate or ultimate analyses are essential before purchasing a fuel, but laboratory results must be considered conjointly with test results on the actual boiler units.

Much to be Learned

Owners must be prepared to spend money on staff and trials to ensure that they are getting the best out of their boiler houses, as few are. There is yet much to be learned about fuels and firing, particularly as regards the class of fuel to burn and which fuels marry best. One must not be too sure that bituminous coals are the very best fuel or that everything depends on size. What suits one station does not necessarily suit another, either as regards efficiency or costs; boiler units vary greatly, as do flues and stacks, and the question of smoke and/or grit must not be overlooked. Much also depends on the situation of the generating station geographically, which, due to freightage, often settles the class of fuel it pays to use.

When the questions of fuels available—sources and reliability of supply—price and the kinds that marry best to suit the purchaser's conditions and plant have been related, the generating staff must be capable (and adequate) to find out the best system of firing, irrespective of what others may be doing with the same class of stoker. There can be no stereotyped system of firing, which depends not only on the units to be handled or the class of fuel used, but also on the operating staff and firemen. Different persons can get different results with the same plant and coal, and what suits one type of operator does not necessarily suit another.

The modern school has different ideas from those of a few years ago; properly handled, its representatives should achieve much in the way of increased boiler efficiency and lowered costs, if they are given the chance to experiment. The weightiest factor to-day in the lowering of fuel costs is undoubtedly getting the right type of men as firemen, and keeping them interested in their work and paying them well. To-day they are all paid alike and receive little incentive to increase their knowledge or to improve themselves or their status.

With the right men firing the boiler units, and with correct supervision provided the most suitable fuel is purchased, much can yet be done to lower station fuel costs, even in the older stations, but the station engineer's hands must not be tied and he must be consulted.

Russian Tool Makers' Complaint

The machine tool manufacturing department of the Soviet Union has been complaining about the scarcity of electric motors which are needed for driving the machines, and has specified instances where hundreds of lathes are idle because the electrical manufacturers have failed to deliver to time. There is a further complaint that the motors are of such out of date design that often it is not possible to utilise them effectively.

A Large American Power Scheme. By F. H. Fullerton

Construction of the Bonneville dam

DEVELOPMENT of hydro-electric power from the Columbia River is a matter of some importance in engineering circles in both the United States and Canada at the present time. The main stream has its source in Columbia lake, at an elevation of 2,650 ft., in the great trough between the Rocky and Selkirk Mountains. The river is concerned in irrigation projects in the areas it traverses, but the main interest on the Canadian side lies in its power potentialities. Plants with an installed capacity of 259,000 h.p. are at present in operation on the river and its tributaries, and according to present data the system in Canada is capable of providing a total of 803,400 h.p. continuous, and of 1,348,000 h.p. during seasonal periods.

It is on the part of the river between the States of Washington and Oregon that two very large power and irrigation projects are now being undertaken by the United States Government. The first is the erection of the gigantic Grand Coulee irrigation dam, and descending to the Snake River, the scene of operations on the Bonneville power project is reached. Work is now in progress at this site under the direction of Major C. F. Williams, Corps of Engineers, U.S. Army, and district engineer at Portland. From the Snake to its estuary the Columbia flows a total of 325 miles and is comparatively straight, with a tidal section 145 miles long extending upstream to approximately the Bonneville dam site. The 180-mile-long non-tidal section, with an average slope of 1.7 ft. per mile, again cuts through the Cascade and the Rocky mountain ranges and between these traverses an area of lowlands.

Bonneville, Oregon, where work is now proceeding on the construction of a large hydro-electric power station

Source of Energy

At the mouth of the Snake River the combined watershed is 212,000 square miles, while below the additional tributary watershed is 47,000 square miles. The mean annual flow at Bonneville is 210,000 ft., the lowest year's record being 60 per cent. of the mean and the highest 150 per cent. The maximum flood flow on record was 1,170,000 second-feet at this point in June, 1894. In all, four dams are recommended below the Snake, as detailed in the following table:—

Site.	Maximum height of dam (feet).	Useful storage (Thousands of feet).	Power capacity (Thousands of kW).
Umatilla Rapids	104	135	318
John Day Rapids	139	245	485
The Dalles	260	80	360
Bonneville	130	100	300

The estimated cost of the Bonneville project is about £6,500,000, and the scheme provides for a gate controlled spillway dam which will create a head of 67 ft. at low water; power plant with two complete sets of 43,000 kW capacity each, with partially completed structure for four additional sets; a barge lock 75 ft. wide, 540 ft. clear length, and a minimum depth of 10 ft. on the sills; and fishways in both the dam and the power house channels.

The design of the power house will permit the future installation of up to ten or twelve further sets of 43,000 kW capacity. The lock is planned as a single chamber of unprecedented lift and is so designed that it may be used as an integral part of a tandem lift ship lock. The gross head at the power plant will be 67 ft., and the dam will create a pool with an area of 30 square miles.

It is expected that by providing liberal spillway gate capacity, and removing obstructive rock ledges and pinnacles in the rapids section, just above the dam, the maximum flood height will not be raised by the dam in the upstream stretch from the head of the Cascade Rapids. On the Bonneville dam the main spillway is to be an overflow gravity type structure and will consist essentially of a base block of mass concrete approximately 75 ft. high, 180 ft. wide, and 1,100 ft. long across the river surmounted by tall piers and abutment walls enclosing eighteen steel gates, each 50 ft. by 50 ft. high, of the vertical lift type and divided into upper and lower halves to permit easy erection and operation by lift cranes carried across the pier tops. At each end there will be a reinforced concrete abutment structure which will provide accommodation for transformer vaults and control rooms for the electrical machinery, as well as a system of conduits and gates required for the fishways.

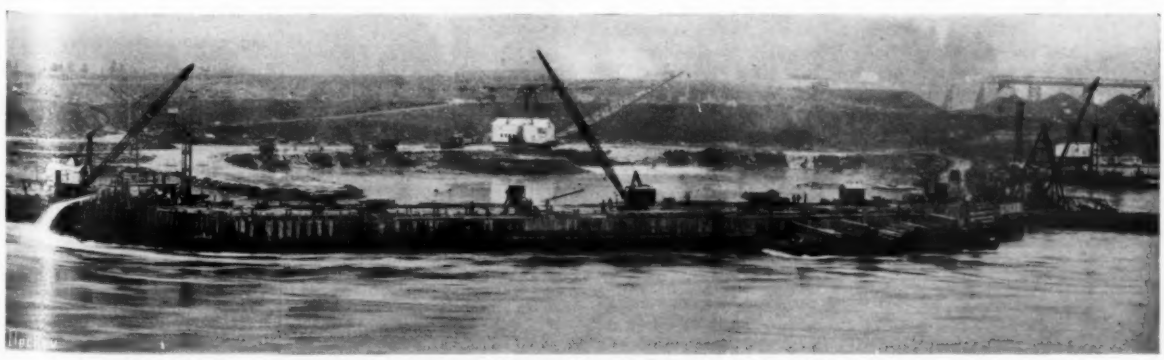
A number of outstanding engineering features are involved in the construction due to the unusual volume of flood water to be safely passed, the comparatively soft rock available for foundation, the large scale river diversion and the construction and dewatering of cofferdams.

Massive Plant

Kaplan propeller type turbines have been selected for the eight initial sets at Bonneville, and they will have blades automatically adjusted for changes in head and load, as the Columbia is unregulated and flow varies from 40,000 to over a million s.f. These turbines will use 12,400 s.f. each, and will rank with the largest in the world. The intake will be 62 ft. in clear width by 40 ft. high. Penstocks are to be eliminated from the concrete intakes which will directly connect to the concrete scroll case.

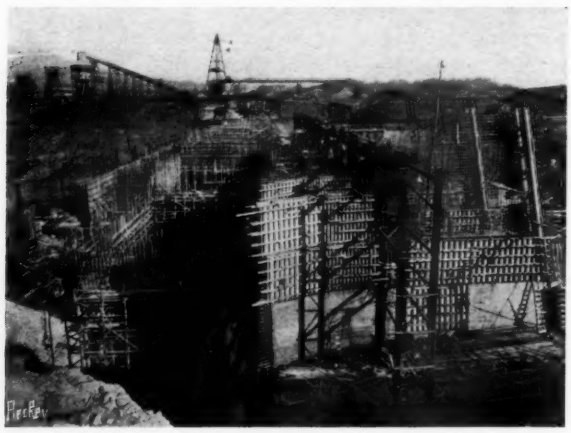
The turbines are each designed for an output of 60,000 h.p. at 500 ft. head, and at 76 ft. head about 86,000 h.p. could be developed if generator capacity permitted. They will each weigh about 1,900,000 lb., and the load on the thrust bearing consisting of the water-wheel, rotor of the generator shaft, and hydraulic throat will be about 1,120 tons.

The generators will each weigh about 660 tons. Three



Unwatering the cofferdam for the south half of the Bonneville dam in the main channel of the Columbia River

vertical lift roller-bearing structural steel gates each weighing 100 tons, are specified for each set, the head gates, trash racks



The power house sub-structure in Bradford Slough

and their rakes being operated by a gantry crane. The completed ten-set power house now planned will be a building with accommodation for six sub-structure and two super-structure units, and will be 1,000 ft. in length and 260 ft. wide, rising 200 ft. above the bottom of the draft tubes, and surmounted by structural steel towers carrying the circuit-breakers.

While there is excellent foundation for one lock it is not wide enough for two, and it was agreed to erect a single lock founded entirely on rock. The maximum lift will be 67 ft. at low water, the normal lift being 59 ft., and at high water 47 ft. These are unusually high lifts for the proposed minimum opening time of three minutes.

Protecting the Fisheries

On account of the importance of the fishing industry on the Columbia special attention has been paid to the design of fishways. Extensive studies are being carried out at the present time as to the effect of passing fish downstream through the turbines.

Between Eagle Creek and Cascade Locks on the Oregon side there is an active land slide about 1¼ miles along its face and a plan to stabilise the slide is now being developed by means of systematic drainage, together with extensive protection at the toe.

It is contemplated that all work with cofferdams will be completed by April 1st, 1937, and that the pool will be raised and the power plant ready for operation by December 31st, 1937.

Floodlighting in Industry. By J. B. Harris

Facilitating night operations

FLOODLIGHTING may be defined as the illumination to an even intensity of a large area or wall surface, the equipment used consisting of a unit giving a highly concentrated beam of light. Since it is usually placed in the open, the unit must be capable of being operated under all weather conditions.

In certain cases, such as dockyards, where operations must be carried on during the night, floodlighting enables this to be done as efficiently as during the day, while road-making may be speeded up by working a twenty-four-hour day. In quarries beam throws of over 200 yd. can be obtained and the projectors can be isolated from the actual working surface, thus eliminating any likelihood of damage to electrical apparatus; this is of particular advantage when blasting is being carried out.

By correctly placing the projectors light beams can be made to overlap so as to avoid dense shadows. In quarrying the working area changes as the work progresses, but adequate and uniform illumination can be easily obtained by the use of portable units. An example of the efficient floodlighting of a large area is the case of a limestone quarry, where the illumination obtained was 1 to 1.5 ft.-candles (vertical plane), 0.3 to 0.6 ft.-candles (horizontal plane). The 1,500-W projectors were placed 600 ft. from the working face and mounted on high masts. Only six units were necessary to give effective illumination.

Before the advent of floodlighting the usual method of illuminating a railway siding was by means of ordinary units fitted to posts and giving a general light distribution over the whole area. The general illumination was therefore lower than that at positions directly below the lamps, thus increasing the risk of accidents. Projectors for floodlighting are usually fitted to poles 30 to 40 ft. in height to avoid shadows from laden trucks, and are constructed to facilitate the frequent cleaning necessitated by the great amount of coal-dust present.

Accident Prevention

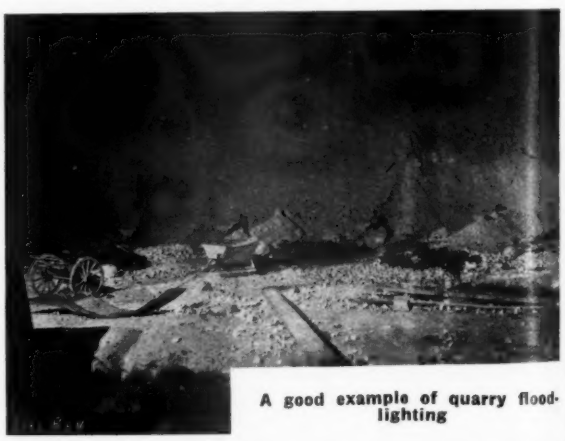
A large percentage of the accidents occurring in the loading and unloading of ships is due to persons falling as a result of bad illumination, but by providing good illumination through floodlighting this hazard may be greatly reduced. The projectors, incorporating suitable beam control, should be mounted high up on the crane platform or runway.

In the type of work executed in shipyards the illumination necessary is usually of a low value over large areas, with a high intensity at certain points. The design of the floodlighting scheme depends on the particular work being considered. For docks and sidings from 0.1 to 0.5 ft.-candles is recommended. The size of the lamp has to be calculated from a knowledge of the illumination required and such factors as depreciation and utilisation coefficient.

The following indicate approximate values in foot-candles: building construction, 4 to 6; building excavation, 1 to 2; colliery yards, 0.5 to 2; loading docks, 2 to 4; quarrying, 2 to 4; railway yards, 0.5 to 2; roadmaking, 1 to 2; and storage yards, 0.5 to 1.

The best type of reflector to secure beam control is of silvered glass, having a reflection factor of 90 per cent. Stainless metal, which is often used where robustness has to be considered, has a reflection factor of 70 per cent. Regarding railway sidings, the chief problem is to determine the number of fittings and to place them so that the best results are secured.

Floodlighting the exterior walls of factories is advantageous from an advertising point of view. The reflection factors of walls vary with the nature of the surface. The following



A good example of quarry floodlighting

table gives average percentage figures for a number of fairly clean surfaces; for dirty surfaces these figures should be halved: white glazed brick, 60; Portland stone, 40; concrete, 30; cream paint, 40; and red brick, 16.

By using various colour screens over the front of the projector very effective results may be obtained. The only disadvantage of the method is that it is rather costly due to the high absorption factors of the screens. The absorption factors, per cent., of various screens are: pale red, 50; pale yellow, 20; pale green, 60; and pale blue, 70.

A more recent development has been the utilisation of electric discharge lamps for colour floodlighting. As the colour of the light emitted by these is dependent upon the gas used, colour screens may be dispensed with, and there is a consequent considerable increase in efficiency, apart from that resulting from the use of the lamps as such. The colours obtainable include red, blue, two shades of green, and yellow. The units, which include a transformer and choke, can be operated from a.c. mains at 200 to 250 V.

Equitable House, Woolwich

ARCHITECTS and builders are realising to an increasing extent the advantages of lay-lighting both from the points of view of appearance and economy. The principle is employed to excellent effect at Equitable House, Woolwich, the new headquarters of the Woolwich Equitable Building Society, where the main illumination of the Banking Hall—both daylight and artificial—comes through the rectangular glass ceiling. Striplights in about 4-ft. lengths have been installed above this ceiling, both round the edges and also down the centre, in the latter case three or four feet from the glass, the apparatus being protected from the weather by a sloping glass roof.

Subsidiary lighting in the Banking Hall is provided by four main octagonal fittings, with thirteen hexagonal fittings, above and below the balconies, oxidised silver and glass being used for their construction to match the counter and the general scheme of decorations. On each side of the entrance is a pedestal lamp pointing upwards.

The floodlighted exterior of the Equitable House, Woolwich, and one of the corridors

Cornice lighting is employed in the Board Room, but for the general office illumination totally enclosed fittings of the hexagonal type are used. Circular fittings have been favoured for the corridors, while small lay-lights have been inset on the landings of the staircases.

Although the building is centrally heated electricity has to be called in to circulate the hot water, two 5-h.p. 1,390-r.p.m. Bull motors, with "Memota" switches, being used for the purpose. The Committee Room boasts a "Magicoal" fire, and the kitchen a "Frigidaire" refrigerator.

The Board Room, Committee Room, and Deed Room are ventilated by electrically operated plant (Keith & Blackman), with push-button control. A central vacuum cleaning plant, operated by a 14-h.p. 1,420-r.p.m. motor in the basement, was supplied by the Sturtevant Engineering Co., Ltd., which was also responsible for a message tube system. Of the three Waygood-Otis lifts, two are fully automatic and the other is equipped with dual control; they are all equipped with cornice lighting.

Incorporated in the fifty electric clocks (Smith's) installed all over the building is a device ("Instanta") whereby the numbers on the dials can be illuminated for locating members of the staff. A Venner time-switch controls the lighting on the exterior clock.

In connection with the automatic telephone installation, Messrs. Siemens Bros. & Co., Ltd., have installed a compact piece of apparatus called a "Transrector" for trickle-charging the accumulators. In the event of a failure in the supply from the Woolwich Electricity Department, a "Keepalite" system maintains the lighting of the corridors and basement.

Messrs. T. Clarke & Co., Ltd., were the electrical contractors for the work, the lighting equipment and lamps being supplied by the General Electric Co., Ltd., which, incidentally, was also responsible for the fifteen fittings which floodlight the building at night. Messrs. Johnson & Phillips, Ltd., produced wiring, switches, fuse-boxes, etc., for the general installation, and "Walsall" conduits were used.

Starting Induction Motors. By M. V. Russell

The effect of voltage on the windings of squirrel-cage machines

THE method of starting a squirrel-cage induction motor has a direct bearing on the resulting effect of the forces acting on its windings, which does not appear to be generally appreciated. Numerous failures have been traced directly to the strain imposed on the windings during the starting period.

A 40-h.p. 440-V unloaded motor was started by a three-pole switch direct on the line at 220, 440 and 660 V, corresponding to 50, 100 and 150 per cent. normal voltage. With 220 V the windings moved 0.002 in., and several seconds were required to bring the motor up to full speed. With 440 V the coils moved 0.01 in. and full speed was attained in one second. With 660 V the coils moved 0.016 in. for four seconds until the motor reached full speed. In all three tests the windings pulled away from the rotor and towards the frame.

Mr. M. V. Russell

Under full-load conditions with the motor thrown direct on the line at normal voltage, *i.e.*, 440 V, the windings moved outward toward the frame 0.01 in., and then vibrated in this position for 1¼ sec. until full speed was reached. The frequency of vibration was equal to that of the supply at first, but it soon changed to twice this value.

With auto-transformer starting, set at the 80 per cent. voltage tap, the coil motion was in the radial direction. The winding moved quickly toward the frame as soon as the motor was started, and then gradually returned to the normal position, continuing toward the rotor. When the change was made from the 80 per cent. voltage there was a quick movement in the reverse direction of greater force than the preceding one, after which the winding returned to its normal position. The cycle of movement in returning to the normal position required ¼ sec. from the time the line voltage was applied.

The movement of the winding in the opposite direction when changing over from the tapping to line voltage was caused by the flux interlinked with the short-circuited squirrel-cage winding lagging behind the primary flux, because a decreasing flux induces a current in the squirrel cage tending to maintain the flux. Under this condition a voltage is induced in the primary winding by the rotating flux of the secondary, which may be out of phase with the line voltage at the moment when the latter is applied to the motor terminals, and consequently there may be a heavy rush of current at this instant.

A further test was made by running the motor up to full speed without load, disconnecting the supply and allowing the speed to fall to about half the normal value. The connections to the motor were then reversed and the motor was reconnected to the supply. The movement of the windings on reconnecting amounted to 0.008 in. toward the frame, and the total time required to stop the motor from half-speed and to bring it to full speed in the opposite direction was 1.3 sec. During the first second 6.8 times the normal full-load current was taken.

Results of Tests

The results show that there was either quivering, vibration or displacement of the windings when the motor was started under all the tested conditions. The severity of the motion, or displacement, increased as a function of the square of the applied voltage independently of the normal rated voltage, but 440 V will produce four times as much coil displacement

as 220 V on a particular winding, regardless of the voltage rating.

Displacement was toward the frame in all cases except with auto-transformer starting, and the windings moved and vibrated in both radial and tangential directions. The amount of movement and its duration corresponded with the starting current and the time that the windings were displaced for any two voltages on a given winding was inversely proportional to the square of the ratio of these voltages

An interesting feature of these tests was the indication of a voltage at the motor terminals after the supply had been disconnected. For the 40-h.p. motor in question, with full load, the induced voltage was 25 per cent. of normal voltage half a second after opening the switch, while a similar test on a 550-h.p. motor with no load showed an induced voltage of 50 per cent. of full voltage ¾ sec. after opening the switch, and 35 per cent. after 1¾ sec. This induced primary circuit voltage had a frequency directly proportional to the speed of the rotor which was slowing down.

The starting of motors with full voltage produces a severe strain for a short period, whereas the use of an auto-transformer starter produces a less severe strain for a longer period and also a momentary strain that may be more severe than when starting with full voltage, as it may produce two severe shocks on the winding in opposite directions. This is accounted for by the voltage which is produced in the winding being out of phase with the line voltage at the instant of changing from the lower voltage tapping to the full-voltage tapping of the starter.

The remarks regarding auto-transformer starting are also applicable to star-delta, and any method which necessitates disconnecting the motor from the supply when changing over from start to run. As auto-starter and star-delta methods of starting were employed where the insulation failed as the result of distortion of the winding in the cases mentioned above, the starter appears to be more of a liability than an asset.

In order to minimise strain on the windings during the starting period it is necessary to reduce the starting current, but as it is also desirable to improve the starting torque it would appear that this can be accomplished much more effectively by other means than an auto-starter. Developments in this direction have led to improvements in the design of the squirrel-cage motor either by incorporating the Boucherot principle of a double cage rotor designed for direct-on starting, taking a starting current of three to four times the normal current and developing 75 to 100 per cent. torque, or the use of a high reactance stator winding when the motor is driving a pump, fan or similar appliance and taking three to four times normal current when developing 40 to 50 per cent. normal torque.

An Improved Method

A third method introduced during the past two or three years involves the provision of an auxiliary primary winding connected in series with the main winding during the starting period and cut out of circuit as the motor attains full speed. This method possesses the advantages of the auto-starter and star-delta methods without the disadvantages, as the motor is never disconnected from the supply mains during the starting period.

The starting torque and current can be predetermined by adopting a suitable number of turns for the auxiliary winding, and the switchgear is simpler than that required for either the auto-starter or star-delta methods. This type of motor has found a suitable application in the case of chain drives, as it completely eliminates the "snatch" which takes place with any of the other methods when changing from start to run positions. With pumps and fans it gives smoother acceleration, thus reducing wear and tear on the mechanical parts to an appreciable extent.

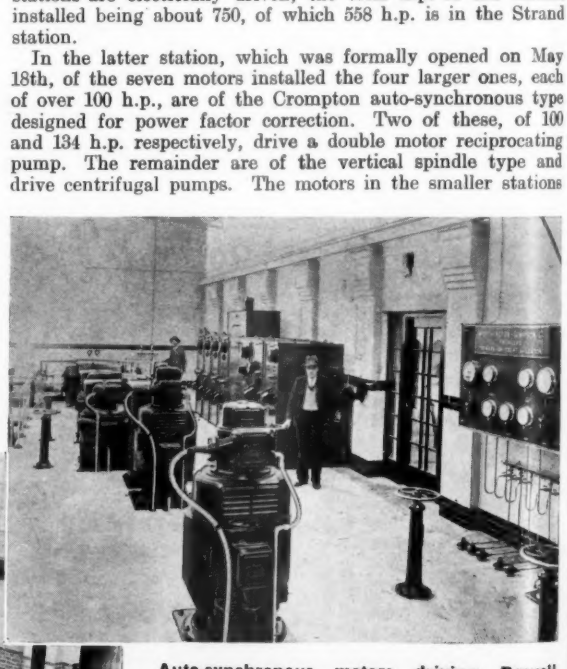
Two Sewage Pumping Installations

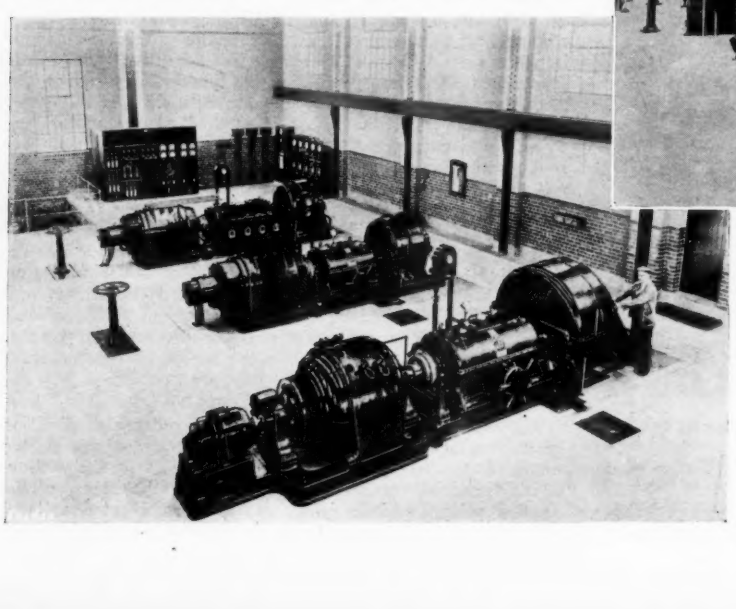
ELECTRICITY has been used throughout the Davyhulme sewage disposal works of the Manchester Rivers Department since 1924, when the steam plant was displaced. Power is supplied by the Electricity Department, and a considerable amount of additional electrical equipment has been installed in connection with new extensions to the works which were opened recently. One item alone, the compressing machinery for the new air diffusion plant of the activated sludge units, has motors totalling 1,890 h.p., the plant consisting of three Reavell turbo-blower units, one of which acts as a standby.

The large unit has a nominal capacity of 15,000 cu. ft. of air per minute, and the capacity of each of the two smaller units is 10,000 cu. ft. per minute. All three are driven by Crompton auto-synchronous motors, one of 810 b.h.p., and two of 540 b.h.p. The motor speeds are 1,000 r.p.m., and each turbo-blower is direct-coupled to a four-speed increasing gear which, in turn, is direct-coupled to the motor, giving blower speeds of 4,182/4,650 in the case of the larger unit and 4,895/5,444 in the case of the smaller.

The Rochester and Chatham Joint Board's sewage works have also been extended to enable Gillingham's sewage to be treated there, Gillingham having become a constituent member of the enlarged Board. This step involved the construction of a main pumping station at the Strand, Gillingham, and four smaller stations at the Dockyard, Hempstead, East Rainham and Lower Rainham. The pumps in all these stations are electrically driven, the total h.p. of the motors installed being about 750, of which 558 h.p. is in the Strand station.

In the latter station, which was formally opened on May 18th, of the seven motors installed the four larger ones, each of over 100 h.p., are of the Crompton auto-synchronous type designed for power factor correction. Two of these, of 100 and 134 h.p. respectively, drive a double motor reciprocating pump. The remainder are of the vertical spindle type and drive centrifugal pumps. The motors in the smaller stations are standard induction machines, apart from two 60-h.p. auto-synchronous motors in the Dockyard station.





Auto-synchronous motors driving Reavell turbo-blower units in the Davyhulme (Manchester) sewage pumping station (left), and the interior of the Strand (Gillingham) sewage pumping station showing a line of motors

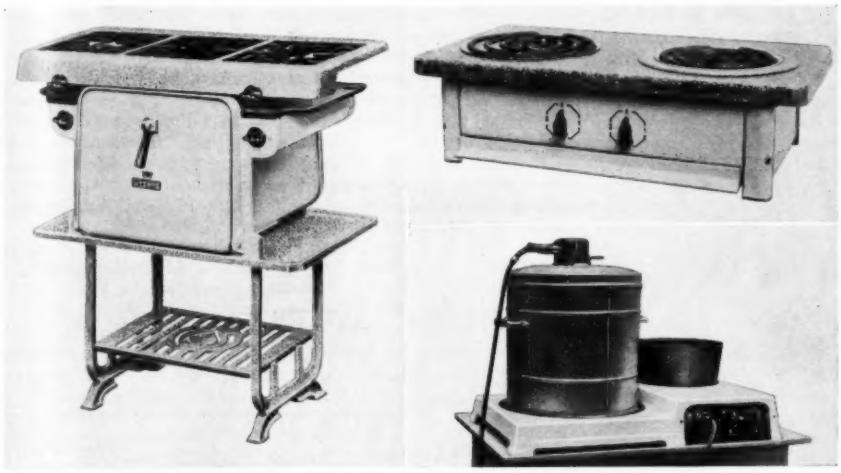
The pumping machinery is by Worthington Simpson, Ltd., while the Contracts Department of Crompton Parkinson, Ltd., was responsible for the power and lighting installations and for the provision of the motors and main switchboard.

Paris Fair and Lighting Congress. By S. H. Kahn

Two notable events of electrical interest

WITHIN the past few weeks there have been held the annual Paris Fair, which is perhaps the oldest and most important of the French commercial exhibitions, and a congress in Paris dealing with the use of electricity for the illumination of buildings.

The Fair is one at which manufacturers make a point of exhibiting their latest developments, and the electrical section this year was outstanding in this respect. For convenience the section was divided into two parts, one of which was devoted to machinery and appliances and the other to radio apparatus. There have been signs in the past year or so that French concerns are taking up the manufacture of motors for special applications, and many new types, formerly made only abroad, were demonstrated. Particular progress in this line has been made by Eve & Noizet, who exhibited a large variety of special motors, including small silent-running motors for various domestic uses which were shown for the first time at the Fair.



Left: A cooker (Arthur Martin) the plates on top of which are heated by gas and the oven by electricity. Right: A dual hot-plate of novel design (top) and a section of an "Electro-Econome" cooker

Several manufacturers showed motors with automatic starting devices, the most common being a system of resistances built into the rotor or attached to the rotor shaft and arranged so that they are cut in or out according to the speed of the motor. Another system, used on the Drouard motors, consists of three resistances connected in star formation, each shunted by an inductance coil. During the starting period the current frequency of the rotor is high and the current passes through the resistances, but as the speed increases and the frequency decreases the current begins to flow partly through the inductance coils. When the motor reaches its maximum speed all the current is passing through the coils and the resistances are automatically short-circuited.

French manufacturers are continuing to develop armoured equipment for various uses, while many connection boxes for use with steel conduit or with lead-sheathed wire and cables are also made by French concerns; formerly these came almost entirely from abroad. Of this type Desmet exhibited a particularly complete line.

A section to which special attention has been paid this year is that devoted to heating, which was organised by the Société pour le developpement des Applications de l'Electricité. In a hall off the main part of the electrical display there was a variety of furnaces and ovens, as well as smaller appliances. As regards furnaces progress was largely in detail improvements, one of which was the fact that most of the exhibits had built-in electric pyrometers. Also of interest in this part of the Fair was a press for moulded material with electrically heated plates and developing 60 tons pressure.

More headway has been made in the case of large electric water heaters. Lemercier Frères showed a series of these, including a 66 gal. model. The same concern also exhibited a battery of two electric water heaters for hot-water radiator systems. The heaters are of the horizonal type and are rated at 100 kW at 600 V. The boilers are heat-insulated as well as the ends of the elements and connections. Each element is equipped with a contactor regulated by a thermostat placed in the top of the boiler and also by a distant control button. A series of heating resistances woven in chrome nickel is shown by Plancher in widths up to about 24 in. and lengths up to 32 ft. 9 in.

With regard to electrical installations a novelty shown was the Socliso connector. This consists of a base in moulded material and a brass bar, the base being designed in such a way that any desired number of bars can be put together without apparent joint. This end is attained by making the base represent one side and the bottom, the second side necessary to hold the brass connection bar in place being formed by the next piece. The brass connection bar is held firmly in place by a series of projections in the bakelite base. These connectors can be screwed directly on to any metal connection box or switchboard.

Among electric cookers the "Electro-Econome" model attracted much attention. It is composed of two plates, one of which is arranged with a bell cover. With this cooker it is possible to prepare dishes without supervision being necessary. This is done by having a connection to the top of the bell which, when a certain temperature is reached inside, reduces the heating to a point at which the temperature is kept constant. The cooker is provided with a series of saucepans which fit on to each other so that two or three dishes can be prepared together. Other accessories permit the bell to be used as an oven, and a large vessel is obtainable in which fodder for animals can be prepared at night. The connected load is 2,600 W, but the average consumption is much lower.

A portico in the entrance court of the Ecole des Beaux Arts silhouetted against the building, which is lighted by incandescent lamps (Cie des Lamps). On the right is an arcade in the gardens, the illumination of which was carried out by Philips

In the radio section there were one or two new sets, but from a technical point of view the industry has made little progress. One which merits special mention is a combined radio-phonograph and sound film projector. In this apparatus the projector is in the back and throws forward the image by means of a series of mirrors on to a screen which folds up into the top of the machine. It takes any ordinary sound or silent film.

Among the illumination schemes carried out on the occasion of the lighting congress was a practical demonstration

at the Ecole des Beaux Arts. This building was lighted by the principal electrical concerns to show the various effects which could be obtained. One façade was lighted by the Compagnie des Lampes. The slight relief of this section made it necessary to place the twenty-five 1,000-W projectors to one side to bring out the form. Yellow screens were used to give a warm light. The same company carried out the flood-lighting of a sculptured wall and statues in the gardens, using four projectors with 450-W lamps. A portico in the gardens was silhouetted in rather agreeable fashion by lighting the part of the building behind it with four 1,000-W lamps and projectors.

The Société Philips lighted the front court with a combination of white incandescent and sodium vapour lamps giving interesting colour combinations. For this purpose thirteen projectors with 100-W sodium lamps and twenty with 1,000-W lamps of the incandescent type were used. The chapel, lighted inside and out by Philips, had three projectors with 1,000-W incandescent lamps on the outside, lighting up the upper part of the building. The lower part was lighted by two projectors with 250-W lamps placed behind a colonnade standing out from the façade. On the left side a moonlight effect was provided to contrast with the warmer colouring of the rest of the building. Four projectors with 400-W mercury-vapour lamps were used for this purpose. In the interior lighting an effect of depth was sought, and this was obtained by lighting up the room proper with four projectors containing 400-W mercury-vapour lamps, arranged at two different depths. One of the lamps at the back was fitted with a blue screen. Contrasting with the blue lighting of the room, the painting on the back wall was lighted with five projectors containing 1,000-W incandescent lamps.

A section of the gardens was decoratively illuminated, a combination of mercury and sodium lamps being used; these brought out the leaves of the shrubbery in a most artistic way.

The lighting of the façade on the Quai Malaquais by Claude Paz & Silva presented particular difficulty, especially as it had to be done by discharge tubes. The tubes, in special reflectors, were placed on a scaffolding across the street to one side of the building in order to bring out the low relief on the façade. So as not to interfere with the traffic in the street the projectors were fitted with screens. The tubes used were neon and mercury vapour combined to give an effect of sunlight.

The entrance gardens of the Ecole des Beaux Arts were lighted in the same way, the tubes being placed on the entablature of the entrance arcades so that the light fell on the trees, statues and the building at the back. The load required for this was 6 kW. In order to obtain an effect of red shadows two similar reflectors containing only neon tubes were placed on the shrubbery, shining upwards and lighting the trees from below.

Sources of Ultra-violet Rays

THE three main divisions of solar radiation received at the earth's surface are infra-red rays of wavelengths from 7,300 to about 25,000 Angstrom units (1AU = 10^{-8} cm.); visible rays from 4,000 AU (violet) to 7,300 AU (red); and ultra-violet rays from about 2,900 to 4,000 AU. The ultra-violet radiations may be divided into the long-wave band from 3,200 to 4,000 AU, and the medium band of 2,900 to 3,200 AU consisting of rays stimulating to living organisms. Ultra-violet rays of less than 2,800 AU wavelength have often a destructive effect on living cells, but such rays are absorbed from solar radiation by the atmosphere. The carbon arc lamp and the quartz enclosed mercury arc emit ultra-violet rays of all wavelengths in such quantities that their use should always be under competent advice. The types of lamp described by J. Roger in *Revue Générale de l'Electricité* emit practically no ultra-violet rays of less than 2,800 AU wavelength, but yield considerable quantities of ultra-violet radiation in the useful range from 2,800 to 3,200 AU.

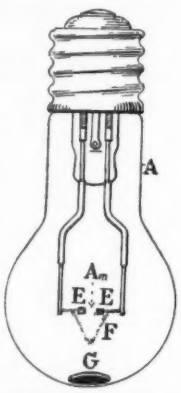


Diagram of the special ultra-violet ray arc lamp

The lamps are of three types, *viz.*:—(1) Over-run filament lamps, operated at about 5 per cent. above normal voltage and lasting 500-300 hours according to their design; (2) a special type of arc lamp operating in an atmosphere of mercury vapour, as explained below; and (3) a luminescent tubular lamp of the hot-cathode and low-pressure mercury vapour type. In all cases the enclosure is of glass transparent to wavelengths down to 2,800 AU.

A Special Arc Lamp

The accompanying illustration shows the essential features of the special arc lamp, a glass bulb with screw cap containing a drop of mercury *G*, and two tungsten electrodes *E* shunted by a coiled tungsten filament *F*. The lamp is fed from an auto-transformer with leakage characteristics such that the voltage at the lamp is at first 30 V, falling to 15 V when an arc is established at Am between the electrodes *E E*, consequent upon the rise in mercury vapour pressure due to heat from the incandescent filament.

The establishment of the arc results in the current increasing from 9½ to 27½ A or from 2 to 8½ A according to the size of lamp concerned. Steady burning is attained in from 5 to 8 mins.

The life of the lamp is reduced by over-running to much the same extent as that of an ordinary filament lamp; it is also reduced, however, by under-running, owing to the delay which then occurs in transferring the arc from the filament to the electrodes *E*. Unless the lamp is kept vertical, there is considerable reduction in the ultra-violet radiation of energy (to about 55 per cent. when the axis of the lamp is at an angle of 45 deg.), this being due to the reduced heating effect of the filament on the mercury.

The following table compares the distributions of energy in the spectra of the newer mercury arc and hot-cathode lamps with that of a quartz-enclosed mercury arc.

RELATIVE DISTRIBUTION OF ENERGY FROM SOURCES OF ULTRA-VIOLET RAYS

Wavelength (Angstroms).	Tungsten electrodes in mercury vapour (400 W).	Hot-cathode mercury vapour discharge (35 W).	Quartz-enclosed mercury arc.
2,530	0	1.580	8.260
2,650	0.736	0.690	6.720
2,700	0.245	0	0
2,750	0.294	0	1.290
2,800	1.715	0.480	3.630
2,890	1.910	2.370	2.080
2,970	7.400	7.300	5.200
3,030	14.450	5.920	10.100
3,130	39.200	35.600	22.300
3,320*	0.270	0	0
3,340	3.130	2.560	3.620
3,480*	0.367	0	0
3,660	29.400	43.500	36.800
3,800*	0.880	0	0
Total relative energy	100.0	100.0	100.0

* Radiation on these wavelengths is from the incandescent tungsten.

Silvered or enamelled surfaces absorb incident ultra-violet rays, but chemically "satinised" aluminium reflects 80 per cent. of these rays and has also a slight diffusing effect. The co-efficient of reflection of polished aluminium is only 40-45 per cent. for rays between 2,800 and 3,200 AU. That of bright chromium is 55-60 per cent., and this finish is used for concentrating reflectors.

While the most beneficial amount of ultra-violet treatment varies considerably with the person concerned, and should always be administered under medical guidance, much progress has been made in the quantitative comparison of the therapeutic effects of different sources. For a given source, there is a definite ratio between the illumination in lux and the intensity of the erythemal effect of the ultra-violet rays. The number of lux-minutes required to produce erythema is approximately as follows:

Source.	Lux-minutes.
Summer sun, at mid-day	1,800,000
Over-run incandescent lamp (500 W)	1,000,000
Tungsten-electrode arc in mercury atmosphere (400 W)	35,000
Ditto (130 W)	65,000
Quartz-enclosed mercury arc	3,000
Luminescent mercury-vapour hot-cathode lamp (35 W)	16,250
Ditto (75 W)	28,500

In order to apply these data it is only necessary to measure the illumination *E* on the irradiated surface by a luxmeter. Then the appropriate value of lux-minutes divided by *E* gives the time, in minutes, for erythema, and the normal period of exposure will be from one-tenth to one-quarter of that time.

Treatment of poultry during the winter, say from 3 a.m., until sunrise, by incandescent lamps emitting ultra-violet rays increases the egg yield and accelerates the maturing of pullets. Animals and plants indigenous to hot countries benefit considerably from such treatment during the winter in northern lands, and increasing use is being made of ultra-violet lamps in zoological gardens, aquaria and stock-breeding establishments, in the testing of materials and for chemical and sterilising processes.

Circuit-breaker Closing

Performance under short-circuit conditions: A new spring mechanism

FROM the point of view of safety of the operator satisfactory performance when a breaker is closed on a short-circuit may be even more important than reliability in opening under such fault conditions. It does not follow that because a breaker is capable of interrupting a given short-circuit kVA it will be capable of carrying, without damage to itself, corresponding inrush currents when being closed. High values of short-circuit current produce considerable electro-magnetic forces which assist the throw-off springs when opening; these forces have the opposite effect when the contacts make on the closing stroke, *i.e.*, the final movement of the moving contact bar is resisted by the electro-magnetic forces. The contact area and pressure are initially considerably less on closing than when all the contacts are in the fully home position, the main contacts then being in parallel with the arcing contacts. The curve in fig. 1 shows the resistance of circuit-breaker contacts from the time when the contacts are touching to the fully home position.

A typical oscillogram of short-circuit current (fig. 2) shows that when it is being closed on to a short-circuit a breaker must carry higher values of making current than breaking current; these higher values have to be carried before the contacts have attained their minimum resistance position. The tendency towards overheating and welding of the contacts, therefore, is much greater in closing than in opening.

When opening, the fixed and moving contacts are mutually supported during the time of maximum electro-magnetic forces which, as well as repelling the moving contact bar, also cause attraction and repulsion of adjacent bars and conductors. When closing under short-circuit conditions the moving contacts are not so supported, and there is thus a greater tendency to mechanical damage of the breaker as well as increased possibility of contact chatter and welding.

Consequently, in order to justify the short-circuit rating of a breaker it is essential to establish its making-capacity rating as well as its breaking-capacity rating.

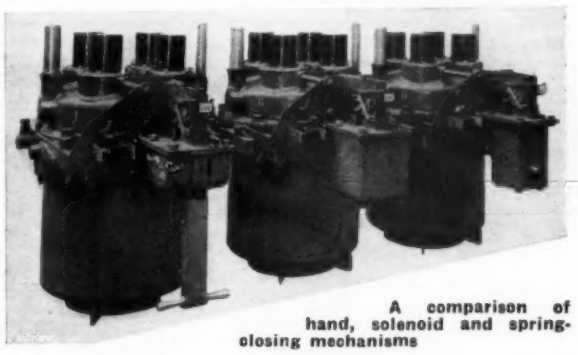
Danger of Slow Operation

The transitional stage from the least possible contact to full contact should be made as short as possible. To accomplish this a breaker should always be closed quickly and without hesitation in case a fault should exist on the circuit which is being switched in.

With hand closing this important factor is controlled only by the experience and strength of the operator. In fact, it would be possible to close a breaker of conservative and excellent design in such a manner as to cause welding of the contacts should the closing movement be sufficiently slow after the point of make. Actually, there is a tendency to hesitate at this point because, apart from the electro-magnetic forces and the spring pressure of the fixed contacts resisting the closing effort of the operator, the latter may be alarmed by hum or other effects of the short-circuit. Any hesitation when the contacts are only partly closed might result, particularly with time-delay relays, in welding up and failure to open; the short could then be cleared only by a back-up breaker at some other point on the system.

A more dangerous possibility of hesitant hand closing would occur should the operator allow the breaker to reopen slightly so as to come out of contact. Arcs would thus be formed and the resulting gas production would constitute a danger if allowed to persist until time-delay protective gear could operate to release the mechanism by the normal method of tripping. In this case the circuit would finally be broken with a gas pressure already within the breaker tank, in addition to that formed due to actual interruption of the arcs. The policy of providing very strong circuit-breaker tanks, such as in the round tank construction, minimises the possible damage in such circumstances, but as with hand operation the operator is standing near to the breaker, it is desirable to take out of his hands completely the possibility of slow or hesitant closing of the breaker.

It is the consensus of opinion among manufacturers that the maximum limit for hand closing should be 150 mVA, or 10,000 A arc current. In the past electrical closing has generally been accepted as a satisfactory solution to the problem of closing high-power breakers, but the necessity for the provision and maintenance of auxiliary supplies has proved an obstacle to the universal use of electrically operated equipments.



A comparison of hand, solenoid and spring-closing mechanisms

For some time, Messrs. Ferguson, Pailin, Ltd., have been carrying out tests with a device that utilises the energy released on igniting a small quantity of explosive material contained in a cartridge.

Spring Closing

Another development incorporates springs which can easily be compressed with a slow movement by hand, the energy so stored being utilised to close a circuit-breaker smartly and without hesitation. The advantage of this kind of gear is that there is no necessity for the provision of a battery or other source of supply.

The mechanism consists of a carriage which is actuated to compress the springs by means of a toggle link. The latter is operated by rotation of a shaft extending through the front of the mechanism cover by means of a suitable lever. The springs are compressed until the link is almost "on toggle," when a small roller latches the link in position. The operating lever is then removed, leaving the spring closing mechanism fully charged. By actuating a small lever, the spring mechanism is released to close the switch; the speed of closing is quite independent of the operator. Alternatively, a small low-power release coil can be fitted if remote operation is desired.

The spring mechanism is housed in a compact case below the main mechanism plate of a breaker and is comparable in size with the solenoid and hand-closing mechanisms. Furthermore, each type of mechanism incorporates the same free handle chain closing device, which permits interchangeability without making any major modifications.

The simplicity and cheapness of the spring mechanism represent a definite advance in design, and the satisfactory operation of the breaker when closing under short-circuit conditions becomes very much less dependent on the human element, while at the same time the onus for this operation is placed more completely on the manufacturer.

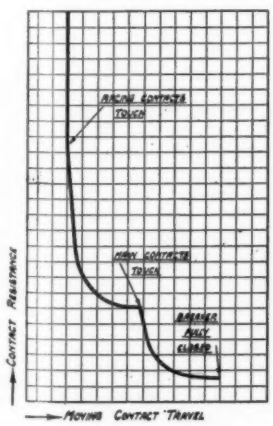


Fig. 1.—Circuit-breaker contact resistance through the closing period

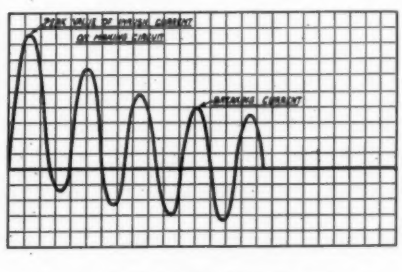


Fig. 2.—Oscillogram showing ratio of making- and breaking-capacity currents

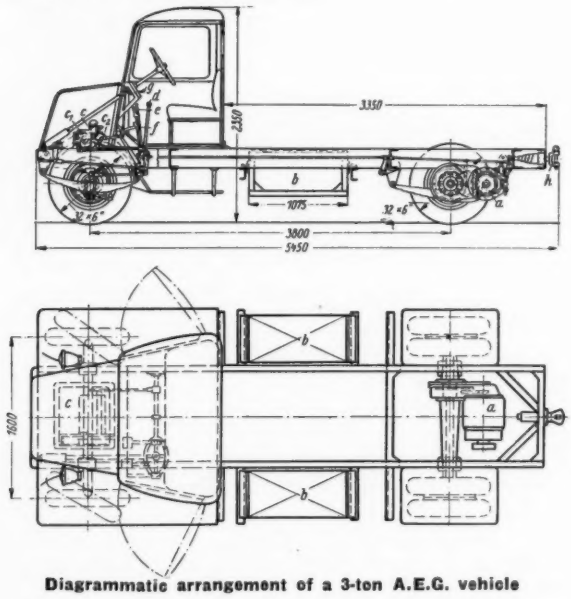
Standard Colours for Voltages

In drawing maps and diagrams of high-voltage transmission networks it is often necessary to distinguish by some means between the different voltages. A standard colour code has been issued by the British Standards Institution (whereby the various voltages may be distinguished) as an addendum to British Standard Specification No. 77-1932, "Voltages for new systems and installations," and copies (Ref.: CD(EL) 6497) will be forwarded gratis on receipt of a stamped envelope by the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1.

Heavy Battery Vehicles

Their advantages for town services

INCREASED attention is being paid to the use of electric battery vehicles in Germany, owing partly to the improved materials and designs now available for the chassis and mechanical details, and partly to the importance attached to the restriction of petrol imports. The general characteristics of a battery vehicle are specially suitable for heavy commercial service, and by taking full advantage of progress in automobile engineering, a simplicity, accessibility and economy of construction can now be obtained in marked distinction to many of the earlier electric vehicles.



Diagrammatic arrangement of a 3-ton A.E.G. vehicle

The main field of utility is in town and suburban service, and where traffic stops are frequent. The rapid acceleration of the electric vehicle more than compensates for its relatively low maximum speed, thus giving a journey speed which is frequently higher than that of petrol vehicles. For such service, says Direktor G. Lucas in *Zeitschrift des Vereines Deutscher Ingenieure*, a modern battery lorry may have a maximum speed of 25 to 30 km (16 to 19 miles) an hour, a radius of action of 60 km (37½ miles), and be able to negotiate gradients up to 1 in 12½. Standardised troughs should be used for the batteries of all sizes of vehicles and arranged to facilitate battery changing.

The accompanying illustration, with dimensions in millimetres, shows the general arrangement of an A.E.G. vehicle for a useful load of 3 tons. The pressed-sheet channels of the side frames are welded to cross stays and battery carriers of similar section.

Special attention should be paid to the mounting of the motor *a*, the fully accessible batteries *b*, and the low centre of gravity and good springing of the chassis. The control gear comprises a controller *c*, grouping and reversing drum c_1 operated by *d*, starting drum c_2, hand and foot brakes *e*, *f*, and main switch *g*. A spring coupling pin *h* is provided on the rear cross beam, which is appropriately stayed. In addition to the hand and foot brakes, electric resistance braking is provided for use on hills. The motor has a 1-hour rating of 13.5 kW at 1,050 r.p.m., 76 V, weighs only 463 lb., and has an efficiency of 82 to 85 per cent.

The grouping and reversing drum c_1 provides three efficient running connections and a braking connection, as well as providing for reverse running; and contactors are used to eliminate arcing on the drum contacts. The pedal-operated starting drum removes resistance in three stages before each running notch, so that there are nine "speeds" forward and one in reverse.

With a useful load of 3 tons, the total weight of the vehicle is 6¾ tons, and a 400-Ah battery gives a radius of action of 37 miles. A load of 3 tons 7 cwt. can be carried if a 250-Ah battery with a range of 18 miles is sufficient. The speed of the vehicle is about 15½ m.p.h. on the level, fully laden, and 18½ m.p.h. empty; it can negotiate short gradients of 1 in 10, and long inclines of 1 in 12½ with a full load. A larger motor is necessary if there are steeper gradients, and a gear box is advisable for use on severe hills where heavier vehicles, for 5 or 6 tons load, are required.

An Acton Radio Factory

SIXTEEN years ago Mr. Edward E. Rosen commenced the distribution, from a Devonshire Square basement, of head-phones manufactured for him elsewhere. A year later a move was made to City Road, and in 1923 the business was transferred to Harrow Road where actual manufacture, as distinct from the assembly of component parts, was commenced. The name of the concern was changed in 1925 to Ultra Electric, Ltd., to embody its trade name.

During the six years that the premises at Harrow Road were occupied the floor space was increased from 6,500 to over 24,000 sq. ft., and the staff grew from 20 to over 250. The cellulose spraying plant installed was possibly one of the first of its kind in a radio factory for the finishing of speaker flares. In the production of "air-chrome" speakers, ageing of the prepared linen diaphragms was an important process for which was developed a system of heating, giving no less than thirty-two air changes per hour at a constant temperature of 170 deg. F.

In 1930 the company produced its first "all-electric" receiver, the A.C.3, the forerunner of the "Twin Cub," which was a 1931 conception of the modern entirely self-contained set. With the removal to the Chalk Farm factory in that year (the Harrow Road works then becoming the Service Depôt) it became possible to make on the premises almost every component used.

The New Building

Now the business is again under one roof. The new factory at Acton, which was opened last week, has been built on the one-floor north light principle with over 25,000 sq. ft. of glass to admit daylight. Altogether it covers more than 150,000 sq. ft., and is capable of accommodating 1,600 operatives. Over £120,000 was spent on its construction.

In the equipment of the factory nearly 20 miles of cable were used and the machine tool and press shop load is 100 h.p., apart from the chromium and cadmium electro-plating vats. Electricity is delivered from the public mains through an oil-cooled transformer sub-station of 300 kVA capacity for 415-V three-phase distribution throughout the factory, which is provided with a pressure hot-water system and air-conditioning plant.

On the assembly benches completed components are built up into chassis form before being placed in their cabinets, and are finally tested by actual broadcast reception. Electrical tests are conducted in specially equipped cubicles, wire-screened to prevent outside interference.

The Development Department

The Development Department is a factory in miniature within the works proper. It is self-contained and has its own office, testing rooms (wire-screened to obviate electrical disturbance and slag-lined to make them sound proof), chemical laboratory, photographic dark room, drawing office, workshop, and its own machine room equipped with precision lathes. The administrative block is a two-storey building fronting on to the arterial Western Avenue. It is outlined with neon tubing and floodlighted at night, and has a clock tower over the central entrance which is surmounted by a symbolic steel pylon. There is a well-equipped hospital in charge of a qualified nurse and adjacent to the factory a staff canteen is to be built.

Following the opening and inspection of the new factory several hundred guests and traders were entertained at luncheon at the Royal Palace Hotel, Kensington. Besides the chairman, Mr. E. E. Rosen, other speakers were Lord Strabolgi, Lieut.-Col. J. T. C. Moore-Brabazon, Mr. A. G. Beaver (president of the Radio Wholesalers' Federation), Mr. J. Fielding (national chairman of the Wireless Retailers' Association), and Mr. J. H. Williams (chairman of the Radio Manufacturers' Association).

There is now being added to one end of the new Acton factory (a picture of which appears on the opposite page) a building that will serve as a motor-car radio fitting depôt, which is expected to be completed some time this summer.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Off-peak Supply

For some time I have been interested in various articles which have appeared in the electrical Press reporting or advocating the sale of electricity during off-peak periods at an extremely low rate per kWh. The principle involved is, of course, the old one of dumping surplus goods at a cost very little above that of the raw material, all other charges being paid by the normal customers. It is very obvious that unless the " very little " is sufficient in the aggregate to make a substantial reduction to the normal customer and thereby tend to increase the normal business, the dumping is a failure.

In Mr. W. B. Woodhouse's article on " Power Supply Prospects," in your issue of June 7th, it is stated that for off-peak supplies, suitably controlled, a price of 0.15d. per kWh is possible and I am wondering if selling current at such a price is of any real value to a supply authority or whether I am taking too narrow a view in looking for such a return as I have stated above.

A supply authority with up-to-date plant selling 500 million kWh per annum with an income of £2 million and buying and handling coal for 20s. per ton might deliver to the busbars at a coal rate of 1.0 lb. The incremental coal rate might be 0.9 lb. per kWh, and at this rate off-peak energy would cost for coal about 0.0963d. per kWh delivered; therefore by selling at 0.15d. there is a maximum profit over coal cost of 56 per cent. This seems an excellent return, but consider the number of units it would be necessary to sell to produce sufficient money to make it worth while.

If the above authority increased its sales by 50 million off-peak units, then its income would be increased by approximately £31,000 or 1.55 per cent. After allowing for the extra coal burned, assuming there were no other costs, the surplus on the year's working would be increased by approximately £11,000, which, if used to encourage the normal consumer, would only be sufficient to allow an all-over reduction of 0.55 per cent.

If my survey of the case is correct, where is the profit to the electricity authorities?

WILLIAM ROSS.

Glasgow, *June 13th.*

The new radio factory of the Ultra Electric, Ltd., in Western Avenue, Acton (see opposite page)

Operation Under the Grid

Some most interesting points are raised in Mr. S. A. Russell's article which appeared in the ELECTRICAL REVIEW of June 7th. Carry-over deposits on turbine blades at one time presented a very serious problem. I have in mind a turbo-alternator which refused to carry above 75 per cent. of its load due to this. Normal conditions were restored by injecting paraffin into the main steam pipe while the turbine was on load, the paraffin having a vaporising point just below that of saturated steam, so that no oily deposit would remain in the boilers as the condensate was used as boiler feed.

Carry-over should be almost non-existent in the modern boiler house, especially where high-pressure and high superheat are employed. It is a source of extreme danger, particularly where superheaters are concerned.

Every endeavour should be made to clean condensers while the machine or machines are on load, as to shut down a set for five or six hours is rather a serious and expensive matter. Chlorination of the circulating water will prevent an accumulation of organic matter and so maintain efficient heat transfer, but extreme care must be exercised in its use; one must not lose sight of its effect upon cast iron, as the circulating water system usually contains a considerable amount of this metal.

Regarding automatic synchronising, engineers know the interpretation put upon the word automatic! In all probability an army of experts would be needed to maintain the apparatus in an efficient state, and this standing charge, together with high initial cost of special equipment and the necessary connections between grid house and the various load and feeding points, is bound to rule it out as a business proposition. The straighter the job the greater the satisfaction and the less the liability to confusion. To my mind, the line to work on is maximum co-operation between generating staffs and the C.E.B.: this is the best way to secure efficiency. I have had considerable experience of synchronising two grid sections, and would never attempt to synchronise with one section low in speed. If it were two stations, then one might attempt it, but even then it is a very risky procedure; the effect upon the switch would be serious.

I have seen switches closed between two sections of the grid with the frequency of each section almost the same, and the kick has been felt over the whole system. This was not due to a " bad shot," but to the transfer of energy from the higher to the lower frequency system.

Try to visualise how much energy transfer would take place if one section of the grid, having a frequency of, say, $\frac{1}{10}$ cycle below normal and a capacity of perhaps 80,000 kW, was synchronised with another section of equal size at normal frequency!

R. WRIGHT.

Carlisle, *June 12th.*

The B.I.F. Criticised

The British Industries Fair at Castle Bromwich is over for another year and complaints have to be offered against those responsible for the arrangements; such complaints should be widely known and all grounds for them avoided in future.

Slackness and inefficiency in business methods were much in evidence. To take an example: I was in the market for an electric cooker and was looking round the stands to find out the salient features of the various makes. I visited one stand and approached the exhibitor who asked me to wait a moment while he was talking to an exhibitor from another stand! I waited for 15 minutes and still received no attention; I am not buying that make of cooker now.

Another instance: An Edinburgh man left twenty-eight business cards with a request for literature to be posted. So far he has had two replies. He also asked for c.o.d. samples from three firms and so far has not had one. An article costing 7s. 6d. and reputed to be selling by hundreds he asked to be sent c.o.d. and is still waiting for it. This is not good for trade.

Courtesy and general knowledge were not much in evidence either. At one stand which made a feature of the balance of the armatures shown, one was on view with large "blobs" of solder on the banding. This I presupposed was the balancing medium used, but when the attendant was questioned he did not know. Apart from being an unsatisfactory method of balancing, surely the least that the exhibitor can do is to make himself aware of his facts.

At another stand I was asking questions about the products exhibited, when another attendant on the stand came forward and took the man away without even an apology. The Fair makes big efforts to attract people, including foreigners, but when visitors arrive the methods employed leave much to be

desired. It was only at the smaller stands, which were under personal supervision of the owners that strict attention was paid to business.

The Scot already mentioned had another grumble which I think is quite legitimate. It is not confined to the Fair, but is common in England. The authorities would not accept without fuss and trouble the Scot's pound note as legal tender. The Scottish banks are owned by or work in conjunction with the English Banks, but they still take poundage on the notes from Scotland. In Scotland they go so far as to accept cheques from travellers; yet the Scot has a reputation for canny dealing. Further, the banks at the Fair closed at 3 p.m., whilst the Fair was open till 6 p.m. If they were really exhibitors and wished to help trade they could surely obtain permission to extend their hours so as to provide service for the whole of that period.

Many Scots came down to see the exhibits and place orders; but the treatment sometimes received was such that they will not readily waste their time on such an expedition again. The home market is as valuable an asset to us as our export market.

More experienced men are required on the stands to explain matters of interest to the buyer. In many cases the attendant was only a young salesman who knew little about the materials exhibited. DESIGNER.

Birmingham, *June 15th.*

Unusual Meter Registration

The ordinary meter reader may well be excused for assuming that something is wrong when he finds a meter, connected in one phase of a three-phase supply, going backwards and integrating fewer and fewer kWh; yet the fact that this may happen and be quite in order was demonstrated by a case that came to my notice the other day.

The service in question was laid in to a small workshop to supply a 2 h.p. three-phase motor driving through shafting a few small machine tools. Welding used to be carried out by the oxy-acetylene process, but to obtain increased speed and reduced warping it was decided to introduce electric arc welding.

A 2/4-kW single-phase 400 V welding transformer was connected between phases through two of the three single-phase meters measuring the supply to the motor, which can be ignored for the present purpose.

It can be shown mathematically that:—

(a) If the current is in phase with the voltage (400 V) applied to the load, then it will lead the voltage (230 V) applied to the meter in the leading phase by 30 deg. and lag behind the voltage (230 V) applied to the meter in the other phase by 30 deg. Thus each meter will register the same number of kWh, being half of the actual consumption of the welder which is the sum of their readings.

(b) If the current lags behind the voltage applied to the load by 30 deg., then it will be in phase with the voltage applied to the meter in the leading phase and will lag behind the voltage applied to the other meter by 60 deg. In this case the meter in the leading phase will register two-thirds of the actual consumption, the other meter registering the remaining one-third.

(c) Similarly, when the current lags behind the voltage applied to the load by 60 deg., it will then lag behind the voltage applied to the meter in the leading phase by 30 deg. and the voltage applied to the other meter by 90 deg.; thus the meter in the leading phase will register the whole of the actual consumption, the other meter remaining stationary.

(d) In the same way, when the current lags behind the voltage applied to the load by 90 deg., then it will lag behind the voltage applied to the meter in the leading phase by 60 deg. and that applied to the other meter by 120 deg. In this case the meters register the same amounts, but whereas that in the leading phase registers in a positive direction that in the other phase will register in a negative direction, so that together they again register the actual consumption (i.e., 0 kWh).

The foregoing describes what happens in the four main stages between a load power factor of unity and zero. It can be shown mathematically that the case is the same for all intermediate stages as well as for a leading load p.f. That is to say, under all conditions of load power factor, the algebraic sum of the readings of two meters connected as described will be a true measure of the actual load consumption.

It can now be seen that in the case cited of the welder, the meter in the leading phase registered as usual while the other went backwards because the p.f. of the load was between 0.5 and zero. Others of your readers may have come across similar curiosities of meter reading.

Southall, *June 18th.* W. H. A. COLLINS.

Eliminating the Contractor

I have received as a supplement to a periodical issued by a well-known house a Jubilee souvenir which takes the form of a collection of photographs. It is very aptly described as "Artistry in Light," and is also artistry in photography. There are twenty-seven illustrations of buildings illuminated for the Jubilee celebrations, some in colour and all very beautiful. Each picture is described, together with the name of those who carried out the work. As a matter of interest I have drawn up a small analysis which shows that the twenty-seven installations were carried out as follows:—Municipal departments, 15; own electrical departments, 6½; contractors, 4½; supply company, 1.

Would it be correct to describe this as a further indication of the growing tendency of employing direct labour and eliminating the contractor? WM. G. BROWN.

London, E., *June 15th.*

The Perth (W.A.) Electricity Undertaking

I notice in your issue of May 31st (p. 791), under the heading of "The Australian Domestic Appliance Market," that you give the system of supply in Perth, Western Australia, as 460-230 V, 50 cycles, single phase a.c. Where this information was obtained I do not know, but it certainly was not by reference to either myself or the Department in Perth.

The system in Perth, which I have the honour to control, is 440-250 V, 40 cycles, three-phase, four-wire supply, and 6,000-20,000 V, three-phase, 40 cycles for high-pressure transmission and bulk consumers.

I shall be glad if you will correct the error which I mentioned in the first paragraph of this letter, as this is very misleading to those for whom it is intended that the article should be of value. As I am in London on business in connection with the extension of our East Perth power station, it was fortunate that this error was brought to my notice and I have taken the first opportunity to correct it. WILLIAM H. TAYLOR.

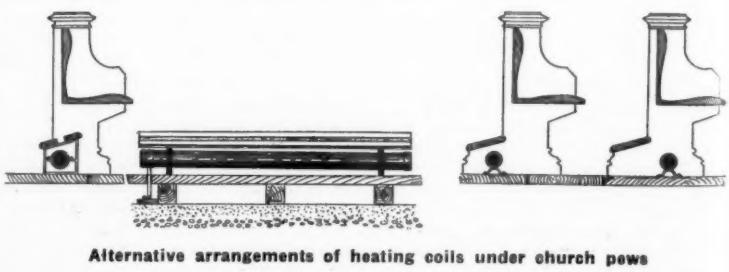
London, W.C.2, *June 12th.*

Church Heating in Germany

THE difficulty of church heating lies in the fact that ordinary heating equipment causes the air to rise, and therefore wastes a great deal of heat in the top of the building. This is the case with practically every type of heating in which the heat is communicated principally to the air. Many German churches are, however, now being equipped with tubular heaters placed under the footrests of the pews so that the heat is transmitted directly to the feet.

The size of the heating elements used is important, for if they are too large the congregation will become too warm, and, more important, the coils will tend to heat the surrounding air, causing it to rise and create draughts. Experiments have shown that in most cases elements of 100 to 150 W per person are sufficient. These elements, which are generally built to the length of the pew, with a consumption of 250 to 300 W per yard length, give a temperature of about 85 deg. F. near the floor and on the footrest, and of 40 to 45 deg. to the height of a person sitting, with an outside temperature of 32 deg.

The heating need be turned on only shortly before the service as its efficiency is much higher than other methods, and it is possible to turn off the heating in vacant pews without affecting the comfort of the rest of the congregation. The German power companies are naturally looking upon these installations very favourably, since they provide a useful off-peak load.



Alternative arrangements of heating coils under church pews

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Indirect Lighting Standard

A new form of indirect lighting fitting of the pedestal type has just been put on the market by ECA-RAY SALES, LTD., 3, Sandland Street, London, W.C.1. It is, in fact, the well-known "Bedford" fitting reversed and mounted on a chromium-plated stand and base; the latter being solid and fitted with ball-bearing castors. Use is made of a silvered-glass reflector, and the glass top can be supplied in opal, frosted, coloured or marbled designs. Small holes concealed under scrolls provide adequate means of ventilation. That the fitting is substantially constructed can be gathered from the fact that it weighs 65 lb. It is guaranteed for five years against peeling or tarnishing.

Pedestal type indirect lighting fitting

Ceiling Fans

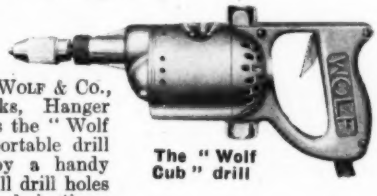
The SUN ELECTRICAL CO.'s revolving ceiling fan has undergone various improvements so that it now rotates about ten instead of three times per minute, thus ensuring better air circulation without causing any downward or direct draught. The motor is suspended from a trunnion and the angle of air disturbance can be altered by changing the position of the set screw in the telescopic transmission rod. There is also a new range of a.c. ceiling fans having curved aluminium blades with a mahogany finish. The company's address is 118, Charing Cross Road, London, W.C.2.

An Easy-to-use Iron

The "Pyramid" iron

MESSRS. HAGUE & MCKENZIE, LTD., Pyramid Works, Sloane Street, Birmingham, 1, claim that a great deal of the fatigue caused by ironing is eliminated by the use of their "Pyramid" model. The handle is of a special shape and the heel of the iron is specially designed to give an easy sweeping glide backwards. Ruby mica is used for the element insulation, and the iron is chromium plated. An "Anka" connector and flex, made by Callender's Cable & Construction Co., Ltd., is incorporated, the flex entering the connector from the side farthest from the user.

A Portable Drill



The "Wolf Cub" drill

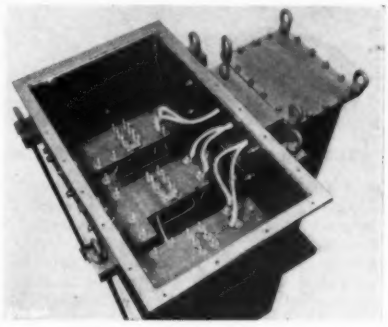
The latest addition to the range of portable electric tools produced by MESSRS. S. WOLF & CO., LTD., Pioneer Works, Hanger Lane, Ealing, W.5, is the "Wolf Cub," a light-duty portable drill which is operated by a handy trigger switch. It will drill holes up to ¼-in. in mild-steel six times faster than by hand drilling. The universal motor is suitable for mains supplies of 100/120 V or 200/250 V, and the light duty loading and speed are 90 W and 2,800 r.p.m. The full-duty speed is 1,300 r.p.m. The machine is supplied complete with a ¼-in. keyless, three-jaw chuck, three yards of three-core c.t.s. cable, an earth lead, a starting switch and a pair of spare carbon brushes.

Automatic Operation of Lift Doors

The "Scott-Winslade" door engine produced by MESSRS. MARRYAT & SCOTT, LTD., 75, Clerkenwell Road, London, E.C.1, is of electrical interest because of its special application to lifts. Upright spindles, one on the outer edge of each door, incorporate rising hinges and are connected to each other at the top through simple crank equipment, by which movement of either door operates the other. The connecting rod works through a dash pot which ensures checking when the doors are closing. For lift work, two drop-bolts fit into the top of the doors at all times except when the cage is at the floor level. A ramp on the cage pushes against a roller and operates the drop-bolts through a simple lever system. The connecting rod can be fitted with an electrical contact which makes only when the doors are closed. It is wired in series with the control circuit and prevents the cage being moved except when the doors are closed.

Voltage Regulation

The B.E.T capacity booster consists of a transformer with its secondary connected to a static condenser. The primary is in series with the line, the outgoing lead being connected to tappings which in the standard type provide reductions in the boost to 90, 80 and 70 per cent. of its normal value. No switchgear is required, and there are no moving parts. The power factor is raised in the same percentage as the voltage, thus often reducing the voltage drop in the line and so increasing the effective boost. At no-load losses are nil and at full-load they are claimed to be less than that of a transformer of the same output. The boost takes place instantaneously and so deals satisfactorily with transient voltage variations due to intermittent and fluctuating loads. Each phase of a three-phase equipment is separately boosted proportionately to its load current. The apparatus is a new development of the BRITISH ELECTRIC TRANSFORMER CO., LTD., Bush House, Aldwych, W.C.2.

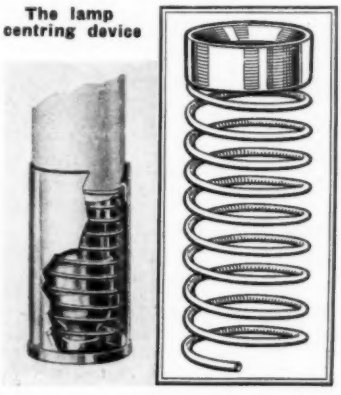


A45-kVA capacity booster with transformer cover removed showing adjustment tappings

Keeping "Candle" Lamps Vertical

A popular type of modern decorative lighting unit is the imitation candle lamp, but with the larger sizes of this style of fitting there is often some difficulty in getting the lamps to remain absolutely vertical. In order to overcome this, HARCOURTS, LTD., 21a, Newman Street, Oxford Street, London, W.1, have introduced a special self-centring device consisting of an inner bush in the candle socket, which compresses a spring as the lamp is inserted. When the lamp is placed in the bayonet socket the slight upward tendency of the bush against the base of the lamp serves to centre it and also protects it against vibration. The device is incorporated in all Harcourt candle fittings, and it can also be obtained separately.

The lamp centring device



Fans with Fabric Blades

Fabric-bladed fans were first introduced last year, but the "Nastrovent" range which is now being made by MESSRS. MARELLI & CO., LTD., 19, Garlick Hill, Queen Victoria Street, London, E.C.4, contains a model incorporating an oscillatory movement, an entirely new departure. The fan has a polished black enamelled metal frame. The motor (either the a.c. induction or d.c. type can be fitted) is controlled by a regulator in the base which gives two operating speeds and an "off" position, while a lever is used for operating the oscillatory movement. There is also a "Nastrovent" fan without oscillatory movement. This model has a moulded bakelite frame and a special tilting adjustment. There is a control in the base for varying the speed up to 1,100 r.p.m., the loading being 34 W.

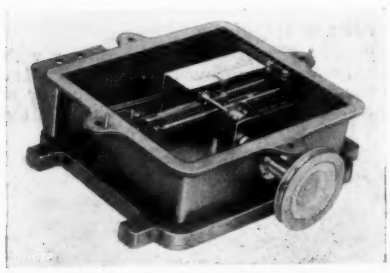
A "Nastrovent" fan

The air delivery in each model is 1,050 cu. ft. per minute, and a 9-ft. twin flexible cord is supplied. The fans are also being retailed in this country by the Sun Electrical Co., Ltd.

D

Remote Movement Recording

For recording or indicating the heights of liquids, MESSRS. GENT & CO., LTD., Faraday Works, Leicester, have recently introduced the "Tangent" a.c. contactless liquid-level indicating, recording and alarm apparatus for 200/250 V, 50 cycles (standard). The transmitter is mechanically connected to the element the movement of which is to be recorded, and is electrically connected to the remotely situated indicator or recorder. Standard overhead or underground conductors, or Post Office "rental" lines may be used if desired.



The "Tangent" liquid-level indicator

No relays are employed and all movements are transmitted continuously and instantaneously. Mains failure is indicated by the recording needle, and upon current reinstatement the instrument immediately takes up the correct position in relation to the transmitter. Only two transmission lines are necessary, and in many cases the system will work with only one line and an earth. Accurate measuring is independent of reasonable voltage fluctuations, and current consumption is negligible. Installation and adjustment are simple, while high and/or low level alarm contacts are provided when required.

A Scintillating Window Sign

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has recently introduced the "Circalite," a simple window display unit consisting of a circular framework mounted on a stepped base and fitted with four special lampholders to take two half-circle "Mazda" light tubes. A "running" light effect is produced by a scintillator in the base.

The "Circalite"

An adjustable and removable platform permits the display of articles inside the ring of light, or, alternatively, when the platform is removed a suitable advertisement card can be fitted in the same clips. Small articles can be displayed on the two steps, while a further card can be inserted in the slots situated on the front of the base.

A Portable Earth Tester

With the increasing importance attached to installation earthing it is now advisable to check from time to time the impedance of earth circuits. MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne, have introduced a portable earth tester by which it is possible not only to check the continuity and resistance of the local earth-wirings in a consumer's premises, but also to measure the impedance of the complete earth-fault circuit from the remotest point of the system, and so ascertain quickly and accurately whether the earthing is sound. The tester can be used for all industrial, domestic and rural installations in which a low-voltage supply is available with its neutral wire earthed at the supply substation. It contains an indicating meter connected in series with a resistance and calibrated in ohms on the basis of a standard voltage. By plugging in to a socket or lamp-holder and touching the metal casing of the apparatus under test with a wander-contact, the meter is connected in the earth-circuit and a low potential is applied to the casing, so that a current traverses the earth-fault circuit, and the impedance of this circuit in ohms is indicated on the meter scale. There are also a small step-down transformer, a polarity-indicating neon lamp, calibrating-resistances, fuses, testing-switches, testing-leads, a dry battery, and a flexible cable with a special adaptor capable of being plugged into a 5-A socket, a 15-A socket, or a lampholder. The flexible cable and the testing-leads are conveniently housed in a hinged compartment on the underside of the case, and a metal spider is provided to wind them on.

Reyrolle portable earth tester

The standard tester is supplied for from 200 to 260 V, model "U" having a range of 0 to 100 ohms and model "R" of 0 to 500 ohms. Each intrument is pre-adjusted to suit the supply-voltage, and a calibrating-resistance enables satisfactory readings to be obtained with a varying supply voltage and when the potential of the neutral wire is above that of the earth. The adjustment is made in a few seconds prior to taking an actual test-reading, with the testing-switch in the "calibrate" position, by turning a knob attached to the resistance until the meter shows full-scale deflection.

An Armature Winding Machine

THE SELSON MACHINE TOOL CO., LTD., 23, Abbey House, Victoria Street, S.W.1., is introducing an armature winding machine, developed by the P. E. Chapman Electrical Works (U.S.A.) and claimed to be two-thirds automatic and to carry out ninety per cent. of the work of winding armatures independently of the operators skill.

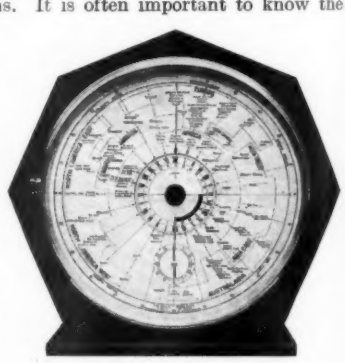
The Selson armature winding machine

Radio Relay Cable

BRITISH INSULATED CABLES, LTD, Prescot, have recently developed a new radio-relay cable of the two-pair type for dual programme. This differs from the firm's standard circular screened cable in that the metallised paper screening is applied as a fillet instead of being lapped round each pair. This construction enables the overall size of cable, and consequently the price, to be reduced. The electrical characteristics of the fillet screened cable are comparable with those of the circular screened type.

An International Clock

Differences in the local times in various countries have given rise to difficulties as a result of the development of international communications. It is often important to know the local time in distant parts, and to supply this information rapidly and in a simple manner an ingenious "World" clock has been constructed by MR. J. H. WILLIS, of Norwich. Made in a form which lends itself to operation by synchronous motor drive and electrically wound mechanism, it is fitted with a large fixed dial ring around which are marked the chief continents and countries, oceans and seas, each at their correct longitudinal position. Lines from the more important longitudinal divisions terminate at the edge of a circular opening in the dial centre, and here is placed an hour dial resembling that of a time-switch and carrying the two sets of figures for a.m. and p.m., and the twenty-four hour divisions used abroad. The edge of this dial is divided into the five-minute spaces of each hour.



The Willis "World" clock

The dial rotates in an anti-clockwise direction, and thus indicates not only the hour of the local time at the point of its own position, but also that of any other place. All that is necessary is to find the line on the outer dial indicating the desired point and then to read the time on the hour dial which is in line with it at the moment. To give more accurate reading, a minute dial is also provided below the hour dial. This has the sixty minutes marked on it and a small hand indicates the reading, as the minutes of standard hours are the same. Variations from standard time in certain countries are provided for.

A Short-wave Signal Generator

A new crystal-controlled short-wave signal generator for the accurate calibration of short-wave receivers and convertors up to 36,000 Kc. has been designed by the PHILCO RADIO & TELEVISION CPN. OF GREAT BRITAIN, LTD., Aintree Road, Perivale. It is known as Model 091.

British Overseas Electrical Trade

Increasing exports of telegraph and telephone apparatus

OUR exports of electrical equipment during May are shown in the Board of Trade returns for the month to have attained the satisfactory total value of £1,069,021, which is an advance of £44,570 on the April figures and exceeds the May, 1934, total by £222,250 (26 per cent.). In the case of April the comparison is disturbed by the fact that there were then two fewer working days. May, 1934, however, had the same number as this year, the occurrence of the Royal Jubilee in last month being offset by Whitsun in the corresponding period of 1934.

Imports amounted to £292,648, a decrease of £61,263 (17 per cent.) compared with the corresponding period of last year. This drop, however, is not significant as May, 1934, was a peak month for imports, but at the same time it is gratifying that there has been no repetition of that increase.

In the first five months of this year exports have amounted to £5,339,215 and imports to £1,347,001 as compared with £4,240,498 and £1,321,404 respectively in the corresponding period of 1934.

Mention has been made in recent months of the expansion in exports of telegraph and telephone apparatus, a tendency which accelerated during May. As is shown in the tabular analysis on the right, apparatus of this kind sent overseas was of the value of £165,414, this being the largest item in the list. Compared with May, 1934, there was an increase of £88,638, Australia and Argentina being chiefly responsible for the improvement. So far this year the value of such exports has reached the excellent total of £650,165, as compared with £389,588 in the corresponding period of last year. Radio transmitting equipment was also in considerable demand, but radio receivers, batteries and accumulators show a falling off. With regard to machinery there was a drop in the value of motor equipment exports, but shipments of switchgear were heavy.

The table below records the chief destinations of equipment exported. A welcome sign is the fact that a few foreign countries considerably increased their requirements in the goods and apparatus section, notably Spain, Italy and Argentina. The destinations of some of the more important specific items in this section, with comparative figures for May last year, were as follows:—

Rubber-insulated wires and cables:—South Africa, £21,912 (£15,196); Australia, £20,635 (£16,289); British India, £14,520 (£17,631); New Zealand, £5,794 (£3,141); other British countries, £15,346 (£7,707); foreign countries, £8,647 (£6,024).

Electric wires and cables (insulation other than rubber):—South Africa, £20,312 (£14,612); British India, £9,169 (£17,062); Australia, £9,019 (£18,709); other British countries, £12,171 (£8,326); foreign countries, £14,219 (£8,858).

Telegraph and telephone apparatus (other than radio):—Argentina, £36,512 (£4,309); South Africa, £34,151 (£29,200); Australia, £20,858 (£6,729); Canada, £1,176 (£815); other British countries, £15,433 (£11,154); other foreign countries, £57,284 (£24,569).

The chief sources from which goods were obtained (May, 1934, figures in parentheses) were as follows:—

Electrical goods and apparatus:—United States, £63,194 (£90,992); Germany, £58,353 (£62,187); Netherlands, £52,380 (£44,642); Switzerland, £14,512 (£15,353); France, £9,645 (£12,781); Belgium, £7,194 (£21,009); Austria, £4,854 (£8,704); other foreign countries, £13,555 (£30,196); British countries, £9,013 (£19,009).

Electric vacuum cleaners came from Canada, £8,043 (£5,489); United States, £4,108 (£5,362); Sweden, £2,340 (£1,757); Germany, £1,440 (£692); other foreign countries, £2,353 (£2,670).

IMPORTS AND EXPORTS DURING MAY

	Exports. May, 1935.	Exports. Inc. or dec. compared with May, 1934.	Imports. May, 1935.	Imports. Inc. or dec. compared with May, 1934.
Submarine telegraph and telephone cables	£184	+ £45	*	—
Telegraph and telephone wires and cables (not submarine)	29,619	+ 5,796	*	—
Other insulated wires and cables	151,744	+ 18,189	£16,597	− £9,540
Radio receivers (not radiograms) excluding valves	10,169	− 9,687	23,795	− 36,447
Radio transmitters (excluding valves)	29,128	+ 23,680	*	—
Radio valves	43,065	+ 18,616	13,196	− 16,573
Other radio parts and accessories	39,604	+ 9,894	59,655	+ 17,719
Telegraph and telephone apparatus (other than radio)	165,414	+ 88,638	*	—
Electric carbons	*	—	8,746	− 6,866
Incandescent lamps	47,417	+ 1,818	9,222	− 11,196
Other lighting apparatus	39,604	+ 8,711	21,512	− 2,258
Primary batteries	10,369	− 8,418	521	− 94
Accumulators	40,583	− 9,945	*	—
House service meters	12,990	+ 4,007	*	—
Other electrical instruments	17,238	+ 741	18,968	− 8,038
Unenumerated electrical goods and apparatus	127,720	+ 24,626	60,490	+ 1,122
Electric generators up to 200 kW.	25,651	+ 13,698	*	—
Electric generators over 200 kW.	39,385	+ 20,448	*	—
Electric motors	73,415	− 16,145	30,050†	+ 12,376
Convertors and transformers	48,339	+ 2,171	*	—
Starting and controlling gear for motors	23,300	− 6,816	*	—
Switchgear	85,760	+ 29,563	*	—
Other electrical machinery	13,203	+ 2,620	11,612	− 3,782
Electric vacuum cleaners	*	—	18,284	+ 2,314
TOTAL	£1,069,021	+ £222,250	£292,648	− £61,263

* Not classified separately. † Not railway and tramway motors.

BRITISH ELECTRICAL EXPORTS DURING MAY

Destination.	Goods and apparatus May, 1935.	Inc. or dec. compared with May, 1934.	Electric generators, May, 1935.	Inc. or dec. compared with May, 1934.	Motors, May, 1935.	Inc. or dec. compared with May, 1934.	Other electrical machinery, May, 1935.	Inc. or dec. compared with May, 1934.
Irish Free State	£25,900	+ £6,457	*	—	*	—	*	—
Union of South Africa	139,038	+ 22,550	£2,455	− £5,387	£20,195	− £6,531	£41,102	+ £8,970
British India	75,186	− 10,942	15,710	+ 3,420	7,982	− 4,368	31,966	+ 2,362
British Malaya	14,216	− 189	*	—	*	—	9,207	+ 6,390
Ceylon	6,267	+ 2,226	*	—	*	—	*	—
Hong Kong	7,930	+ 2,904	*	—	*	—	*	—
Australia	93,697	+ 15,929	3,115	+ 645	10,751	+ 6,602	8,884	+ 3,750
New Zealand	39,510	+ 13,385	*	—	2,794	+ 1,034	6,422	+ 3,136
Canada	7,782	+ 2,962	502	+ 348	2,549	− 1,153	1,611	− 889
Other British Countries	50,777	+ 14,896	12,570	+ 8,912	9,934	− 403	27,347	+ 11,158
Sweden	12,393	− 1,204	*	—	*	—	*	—
Denmark	19,099	+ 5,100	*	—	*	—	*	—
Belgium	11,460	+ 2,410	*	—	*	—	*	—
France	12,660	+ 1,744	*	—	*	—	3,589	+ 1,619
Spain	13,502	+ 8,587	*	—	*	—	*	—
Italy	21,578	+ 18,637	*	—	*	—	*	—
Greece	6,593	− 3,040	*	—	*	—	*	—
Egypt	13,256	+ 6,940	*	—	*	—	537	− 6,098
China	7,451	− 3,299	*	—	*	—	9,331	+ 5,663
United States	3,345	− 1,687	*	—	*	—	*	—
Argentina	53,031	+ 35,691	*	—	2,462	+ 1,379	1,914	+ 1,345
Soviet Union	*	—	*	—	31	+ 30	40	− 681
Netherlands	*	—	14	− 66	*	—	1,286	− 3,281
Other foreign countries	130,237	+ 36,654	30,670	+ 26,274	16,717	− 12,735	22,426	− 5,906
Total	£764,908	+ £176,711	£65,036	+ £34,146	£73,415	− £16,145	£165,662	+ £27,538

* Not classified separately.

Huge Electric Water Heaters

The operation of the gates of the Mississippi River dam which the American Government is building at Canton during freezing weather next winter and spring is to be facilitated by the application of electric heat. For this purpose large "Calrod" type heating units are being manufactured by the General Electric Co. of America. The dam is of the roller-gate type and the main gates will consist of drums placed horizontally across the stream. The ends of the drums will rest on sills built into the concrete piers and will be so arranged that each drum can be partially rotated and raised to vary the flow of water, or allow ice to pass during the spring thaw. In order to permit all-the-year-round operation it will be necessary to keep the ends of the drums free of ice. The electric heaters will be installed in the drum ends and pier sills to prevent freezing. Some of these heating units are to be 27 ft. long, but the power required to heat a roller end will be only 18 kW.

Spain's Electrical Imports

United Kingdom's share of machinery market well maintained

OFFICIAL returns of Spain's foreign trade for 1934 have recently been issued. From this we have extracted the following figures relative to the value of imports of electrical machinery and apparatus, notes of increases or decreases on 1933 being added. The par value of the peseta, in which values are shown, may be reckoned at about 22 to the £. It will be noticed that the United Kingdom has well maintained its share of the trade in the machinery group, although it is still comparatively small. Apart from one or two increases in the totals of this group, the only noteworthy advance is in the radio business, of which, however, the United Kingdom's share is at present practically negligible.

	1934. Pes. (Thous.)	Inc. or Dec.
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts up to 5 kg.—		
Total	1,168	− 112
From Germany	466	− 138
„ France	141	− 57
„ Switzerland	51	− 50
„ United Kingdom	103	− 9
„ United States	274	+ 85
„ Italy	90	+ 67
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts from 5 to 25 kg.—		
Total	2,227	+ 761
From Germany	595	+ 23
„ France	248	+ 81
„ Sweden	319	+ 69
„ Switzerland	90	+ 18
„ United Kingdom	132	− 20
„ United States	702	+ 513
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts from 25 to 100 kg.—		
Total	793	− 59
From Germany	270	− 91
„ France	46	− 57
„ Switzerland	97	− 8
„ United Kingdom	132	+ 27
„ United States	162	+ 53
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts from 100 to 500 kg.—		
Total	957	+ 117
From Germany	286	− 5
„ France	60	− 26
„ Switzerland	105	− 6
„ United Kingdom	186	+ 106
„ United States	80	+ 11
„ Sweden	105	+ 31
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts from 500 to 1,000 kg.—		
Total	421	− 32
From Germany	94	+ 10
„ Switzerland	98	+ 29
„ United States	121	− 22
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts from 1,000 to 3,000 kg.—		
Total	705	+ 22
From Germany	168	− 109
„ Switzerland	138	+ 39
„ United Kingdom	165	*
„ United States	100	− 23
„ Sweden	82	− 36
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts from 3,000 to 5,000 kg.—		
Total	259	+ 169
From Germany	72	+ 66
„ Sweden	5	− 22
„ Switzerland	120	+ 106
„ United Kingdom	35	+ 35
Dynamos, motors, fans, alternators, transformers, starters, rheostats and parts over 5,000 kg.—		
Total	1,700	− 883
From Germany	383	− 253
„ Switzerland	339	+ 167
„ United Kingdom	290	*
„ United States	262	− 1,312
„ Sweden	333	+ 333
Generating sets and rotary converters up to 1,000 kg.—		
Total	239	+ 85
From Germany	88	+ 13
„ United Kingdom	33	+ 2
„ United States	35	+ 14
Generating sets and rotary converters from 1,000 to 5,000 kg.—		
Total	105	− 180
From Germany	—	− 126
„ United Kingdom	11	− 62
„ Switzerland	46	+ 15
Generating sets and rotary converters over 5,000 kg.—		
Total	28	− 21
Elec. meters, voltmeters, ammeters and electro-medical apparatus—		
Total	1,384	− 206
From Germany	501	− 180
„ France	114	− 120
„ Switzerland	438	− 42
Switchboards—		
Total	344	+ 128
From Germany	64	− 19
„ United States	152	+ 71
Heaters, cookers, hot plates, etc.—		
Total	214	+ 19
From Germany	118	− 20
„ United States	49	+ 36
Accumulators—		
Total	497	− 8
From Germany	46	− 37
„ United Kingdom	120	+ 82
„ United States	203	− 7
Dry batteries—		
Total	286	− 55
From Germany	91	+ 90
„ Denmark	131	+ 131
Cables, over 1 cm. diameter—		
Total	334	+ 46
From Germany	203	− 30
„ United Kingdom	44	+ 27
Cables, not exceeding 1 cm.—		
Total	119	− 10
From Germany	34	+ 3
„ France	15	− 29
Insulated wire and cable, less than 0.5 mm.—		
Total	60	− 61
From Germany	17	− 16
„ United Kingdom	16	—
„ United States	16	− 27
Telegraph and telephone apparatus—		
Total	16,119	+ 6,200
From Germany	1,069	− 294
„ Holland	3,284	+ 756
„ United States	9,506	+ 4,577
Lamps, complete—		
Total	532	− 187
From Germany	347	− 114
„ Holland	70	− 43
Switches, circuit breakers, lamp holders and lamp caps—		
Total	2,887	− 130
From Germany	1,525	− 191
„ United Kingdom	103	− 127
„ United States	300	− 60
Wireless valves—		
Total	1,423	+ 662
From Germany	54	+ 13
„ Holland	241	+ 39
„ Hungary	104	− 34
„ United States	888	+ 684
Mercury vapour lamps—		
Total	230	+ 43

* Not specified in 1933.

The Japanese Electrical Industry

DURING the past few years the electrical industry has probably expanded more than any other in Japan. A Department of Overseas Trade report, relating to the economic conditions in that country during 1933-34 (H.M. Stationery Office, 3s. 6d.), states that the maximum capacity of electricity supply for power and traction, excluding power generated and consumed by private enterprises for their own purposes, increased from 950,000 kW at the end of 1922 to 3,078,000 kW at the end of 1932, the paid-up capital now invested in the industry being about 3,500 million yen.

Thermal Power Stations Increasing

Owing to its physical formation, with central mountain ranges and a short fall to the sea, Japan is well suited to hydro-electric development and until recently it was in this direction that the greatest advances in the industry were made. However, as the use of water power developed and approached the potential available, and as industry came to depend increasingly on electric power, the need arose for auxiliary and emergency plants, with the result that among the plants under construction in 1933 and 1934, thermal generating stations predominate, the most important being the Kwansai Kyodo Karyoku Coy's. station comprising two 53,000-kW steam turbine sets.

Though showing so much progress, the electricity supply industry has not been without its vicissitudes. During and just after the financial crisis of 1927 the supply companies, which had been financing their development by domestic and foreign borrowing on a large scale, found themselves with a surplus capacity and a stationary, or in some cases decreasing, demand Rationalisation Policy.

The deflation policy of the Government in 1930 and 1931 brought increased difficulties, since industry as a whole was obliged to retrench and rationalise; and the industrial recovery which commenced in 1932 did not at first benefit the electricity supply companies, because the accompanying decline of the *yen* exchange almost doubled the burden of their foreign debt.

There was fierce competition among the leading companies, and creditors began to get alarmed. The Government then intervened, and in 1932 an Act was passed which provided for a considerable degree of Government supervision of the management of the industry, and gave to the State certain powers of control and veto in respect of rate-fixing and plans for the extension of equipment, while authorising compulsory purchase if deemed advisable.

By 1933, however, the position of the supply companies had much improved. The leading companies had formed a cartel in 1932, and some of the abuses of duplication and competition were thus removed. In spite of the settlement of pending disputes, the years 1933 and 1934 were not free from controversy, and expert observers doubt whether voluntary cartelisation will be sufficient to solve the problems of supply and distribution. It is therefore thought that some further measure of Government control will ultimately be introduced, but it is early yet to say what form it will take. The total capacity of generating stations at the beginning of 1934 is stated to have been 4,933,061 kW, made up of water power 3,105,930 kW and thermal power 1,827,131 kW. Of this total the supply company's share was 4,275,199 kW.

Wide Distribution

It is estimated that no less than 80 per cent. of the population use electricity. This wide distribution is, however, due only to lighting, and is accounted for chiefly by the fixed-rate system, based on the number of points and not on consumption. The consumption per head of the population is relatively low, namely, 155 kWh per annum. The use of electric power in industry is rapidly increasing, especially in the chemical industry and the manufacture of rayon. A considerable expansion of supply is therefore to be anticipated.

The Earthquake at Quetta

Overhead line equipment practically undamaged

HEAVY snow in winter, severe heat and dust storms in summer, a difference of 80 deg. between night and day temperatures, make the climate of Quetta, Baluchistan, one of the most trying in the world for the transmission engineer. Such were the terms used when describing the electrification of that North-West Indian frontier town, which was carried out by the Indian Contract Dept. of W. T. Henley's Telegraph Works Co., Ltd., for the Quetta Electric Supply Co., Ltd.

The photographs then published (ELEC. REV., March 13th, 1931) form a striking contrast to another set of pictures just received by air mail which reveal some of the terrible results of the earthquake that occurred there three weeks ago.

The extent of the devastation is clearly indicated in the left-hand picture, which, however, shows that, although the buildings on both sides of the street totally collapsed, the l.v. overhead distribution line remained almost intact, in spite of the stresses which must have occurred by reason of the service lines and sub-mains pulling on the main lines when the buildings subsided. This is indicated to a certain extent by the way the service line from the first pole is holding in an upright position the corrugated iron roof of what remains of the building in the left foreground.

The second photograph is a view of Bruce Road, which was the principal street in the city. It shows how extraordinarily well the overhead lines stood up to the shocks. All the poles remained plumb in this street, with the exception of the terminal pole in the foreground, which must have taken the full impact of the adjacent two-storied building.

A further interesting feature of this picture is that it shows a Henley feeder pillar (indicated by arrow) at the foot of the terminal pole. It is one of the old sheet steel type, and obviously quite a lot of the building must have fallen on it, but it appeared to be undamaged after the debris was cleared away, presumably to isolate the low-voltage city feeders.

All the photographs taken in the devastated areas show Henley lines intact, except where buildings actually fell on them, and many people who have returned from Quetta have commented on the soundness of the work which enabled the lines to be put back into working order again with the minimum of cost and trouble.

These two photographs give an excellent idea of the tremendous strain which the overhead line equipment had to withstand at Quetta during the earthquake. The arrow in the right-hand picture indicates a feeder pillar still erect

The Quetta power station itself was not severely damaged, and is reported to have supplied a limited amount of power almost continuously from the time of the earthquake.

Quetta is divided into two portions, consisting of the city and cantonment areas, between which is a deep "nullah" or ditch. Although it affected the whole district, the earthquake caused complete devastation only on the city side of the "nullah." This is attributable to the fact that the city was built on a greater thickness of earth than the cantonment, the intensity of the shock being thus intensified on the city side. The Royal Air Force area, which suffered so severely, was to the south of and midway between the city and cantonment.

The electrification of all three areas was carried out by Messrs. Henley's. At the time of the contract Mr. L. C. Sillar (who is assistant in charge of the company's Lahore office) was a member of the outside contract staff and was the company's resident engineer on the site.

New Books

Shellac. By E. J. Perry. Pp. 240+22; figs. 15. London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d.

This work is, as far as we have been able to ascertain, the only one that deals entirely with the various aspects of shellac. The author draws upon the existing scattered literature on the subject, but also culls much information from his own analytical experience and refers to new fields awaiting development in Burma. The natural history of the lac insect as affecting the production of the article is first considered in some detail. The preparation, manufacture, analysis, and chemistry of the material are also treated in such a manner as to convey a large amount of information within a small compass, and accounts of several recent important investigations are included. A chapter on the commerce of lac should not be overlooked by the chemist, as it contains much useful technical matter. While direct electrical references are few—the chief one being a description of the flow-test apparatus used by Electric & Musical Industries, Ltd., and by Metropolitan-Vickers Electrical Co., Ltd.,—the work can be recommended to anyone engaged in the manufacture of resinous insulating material.

Introduction to Electric Transients. By E. B. KURTZ & G. F. CORCORAN. Pp. 335; figs. 87. London: Chapman & Hall, Ltd. Price 22s. 6d. net.

This welcome book is divided into three parts, the first dealing with d.c. transients, the second with a.c. transients, while the third consists of appendices relating to the differential equations of elementary circuit theory, Heaviside's operational calculus, the Græffe method of solving algebraic equations, and finally exponential and hyperbolic functions. The authors have considered each type of transient from the aspects of physical considerations, mathematical analysis and oscillographic verification, working from simple circuits containing different combinations of R, L, C and M up to consideration of the power transients encountered in transformers, a.c. motors and alternators.

The mathematics employed throughout the work is of simple differential forms only and need cause no concern to quite elementary students. The literature on the study and investigation of transients is growing steadily and much of it is necessarily of an advanced nature. The present book forms a particularly valuable guide to the foundational study of transient phenomena, without a thorough grasp of which a full understanding and appreciation of all that is involved in power systems and apparatus under transient fault conditions cannot be gained. The production of the work leaves nothing to be desired and the oscillograms are particularly clear and well reproduced.

* * *

Shorter Notices

"Energieübertragung und-umwandlung mit Wechselstrom." By P. Werners. Pp. 203; figs. 208. Price Rm. 18. "Elektrotechnik," Volume 2, "Gleich und Wechselstrom-Maschinen." By F. Moeller and Th. Werr. Pp. 125; fis. 111 Price Rm. 10. Leipzig: B. G. Teubner.

"Everyman's Wireless Book." By F. J. Camm. Pp. 288; figs. 243. London: Geo. Newnes, Ltd. Price 3s. 6d.

"Worked Examples in Electrotechnics—Part I," by H. Turner Aspinall. Pp. 141. London: E. & F. N. Spon, Ltd. Price 5s.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

New B.I. Showrooms

British Insulated Cables, Ltd., has now opened showrooms at 52, Grey Street, Newcastle-upon-Tyne, where examples of all its principal manufactures are displayed. These include a range of cables, boxes and pillars, meters, cutouts and similar accessories, traction fittings and bare conductors. Small wires

The new showrooms of British Insulated Cables, Ltd., at Newcastle-upon-Tyne

such as flexibles, cotton- and silk-covered and enamelled wires are effectively displayed in showcases. A special feature is made of resistance welders, and arrangements have been made to operate these so that demonstrations of welding can be given on the spot. Amongst the machines is a miniature one, specially designed for dental work. There is also a large selection of photographs showing various activities of the company both in the works and outside.

The Northants Agricultural Show

The accompanying illustration shows the combined stand of the Kettering U.D.C. Electricity Department and the Northampton Electric Light and Power Co. at the Northamptonshire County Agricultural Show held recently at Kettering. In sending us the photograph Mr. W. A. Walker, the Council's electrical engineer and manager, says that the stand was a centre of interest, and it was gratifying to note the marked increase in the appreciation of the various applications of electricity to agriculture shown by farmers. Continuous cooking demonstrations created a steady flow of visitors to the stand, and good business was done.

The E.D.A. July Programme

A preliminary announcement regarding an extensive Press advertising campaign for the forthcoming autumn and winter seasons appears in the July programme of the British Electrical Development Association. Concurrently with this scheme a national effort will be made to increase the sales personnel of electricity supply directly with a view to accelerating connections and obtaining at least one million new consumers. The suggested window display for July is illustrated with particulars of dimensions, colouring and price. There are also illustrations of "made-up" models of the kitchen and bathroom cut-outs described in the June sales programme. A composite page shows some appropriate summer advertising selected from the E.D.A. Advertising Service Book. The usual price lists of special E.D.A. publications and seasonable posters are given.

A Jubilee Floodlighting Souvenir

The General Electric Co., Ltd., has published a souvenir supplement to the "Osram-G.E.C. Bulletin," illustrating a few examples of floodlighting installations carried out with its apparatus in London and the provinces during the recent Jubilee celebrations. The illustrations include such historic buildings as Hampton Court Palace, Westminster Hall, St. Paul's Cathedral, and Bargate, Southampton. Many of the pictures are in colour.

A Graveyard for Cookers

An unusual method of advertising electric cookers has been adopted by the Orange & Rockland County Electric Co., at Monroe, New York. According to the New York *Electrical Merchandising* old gas, oil, and even very old electric cookers are stacked in a yard bordering a roadway, while above them is a large notice bearing the words "Electric ranges have replaced these gas, oil and coal stoves. Watch the pile grow!"

Light-Vision Demonstrations

Most people are content to provide just enough light by which to see. A mass of statistical evidence has, however, been collected by the E.L.M.A. Lighting Service Bureau for impressing users with the need for protecting their eyesight from abuse, and at the recent National Electrical Convention Exhibition visitors were invited to judge from tests made by themselves the amounts of illumination they would like to have in their own homes.

The apparatus consisted of a cubicle containing a chair, two lighting fittings focused on to a newspaper on a table, and a rheostat similar in appearance to a tramcar controller, by which the illumination could be varied between the limits of 4 and 350 foot-candles, and which delivered a printed ticket marked with the value of illumination chosen. The readings are automatically recorded, and the Bureau is endeavouring to ascertain the requirements of 10,000 people by the end of the year. Most people choose values between 50 and 250 foot-candles, with 125 foot-candles (at least ten times as much as most persons actually use in their homes) the most popular figure. Up to the age of sixteen only about 75 foot-candles may be required, but over sixty years of age values nearer to 250 foot-candles are preferred for comfort.

For the use of the electrical trade, apparatus of both showroom and portable types is available at £6 (less light meter) and £8 15s. (less lamp and light meter) respectively, and already some twenty-seven electricity supply authorities, as well as twelve manufacturers and contractors, in different parts of the country are using, or contemplate installing, the equipment.

In addition to these light-sight testers a "study lamp" has been devised, in appearance an ordinary portable lamp, which uses a 100-W pearl lamp in an opal reflector-diffuser, surrounded by a vellum shade lined with white inside. The reflector directs approximately half the light upwards towards the ceiling, to provide bright surroundings and to eliminate contrast glare, the remainder of the light being diffused downwards and providing far more illumination than usual. The specification for these lamps is being considered by the E.A.W., the E.L.F.A., and E.L.M.A., and, although different makes will vary in detail, the lighting performance of all will be up to the standard set by the first of the type.

The stand of the Kettering Electricity Department and the Northampton Electric Light Co. at the Northants Agricultural Show

Notes on Estonia

The Department of Overseas Trade has published a pamphlet entitled "Hints for Commercial Visitors to Estonia," prepared by H.M. Consul at Tallinn. This contains a commercial summary, and includes information regarding travelling facilities, hotels, cost of subsistence, and regulations for travellers carrying samples.

Standard Socket-outlet Adaptors

A British Standard for socket-outlet adaptors of the 3-pin type has now been issued in which the safety conditions required by the I.E.E. Wiring Regulations (*e.g.*, non-reversibility, position and type of fuse, etc.) are incorporated together with the essential dimensions to ensure interchangeability. This British Standard is issued as an addendum to B.S.S. No. 546-1934, "Two-pole and earthing-pin plugs and socket-

outlets, and copies (Ref. CD(EL) 6498) will be forwarded gratis by the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, on receipt of a stamped envelope.

Works Visit

Between forty and fifty members of the Bexhill-on-Sea Corporation Electricity Department's staff and workpeople spent a happy as well as instructive afternoon at the Telegraph Construction and Maintenance Company's works at Greenwich on Wednesday last week. Boarding launches at the Tower Pier, the visitors enjoyed a short river trip before looking over the company's cable-laying ship, the *Dominia*, which indeed they found so interesting that there was very little time left to inspect the factories. A brief tour of the laboratories, the gutta-percha, submarine and power cable works, however, gave a general idea of how an up-to-date cable works is run. Incidentally, it is of interest that the Bexhill Corporation was one of the T. C. & M. Company's first customers when it started producing power cables in addition to submarine cables a year or so ago. Sir Geoffrey R. Clarke, managing director of the company, greeted the visitors at the works. After tea in the canteen Mr. F. F. B. Wilmshurst, chairman of the Bexhill Electricity Committee, thanked the company for its hospitality and said it was an education to see the amount of trouble and research necessary to produce the finished cable. Mr. L. Ransom, works manager, responded, and a telegram was sent to Mr. C. A. Frost, the Bexhill borough electrical engineer, who is suffering from sciatica, regretting his inability to be present.

American Domestic Figures

"In ten years 6,000,000 homes have acquired refrigerators—using 2,500,000,000 kWh annually—the present rate of increase exceeds a million kWh a year—14,000,000 customers still lack them. Only one home in twenty has a range. Nearly all customers have flat-irons but only half have cleaners, washers or toasters."—*Electrical World*.

The Public Works, Roads, and Transport Exhibition

The Public Works, Roads and Transport Congress and Exhibition will be held at the Royal Agricultural Hall, N., from November 18th to 23rd. The exhibits will include all classes of machinery, plant and materials used in connection with every phase of municipal enterprise, including vehicles specially designed for municipal requirements, and street lighting. Invitations will be extended to various associations and institutions to take part in the Congress, among them being the I.M.E.A., the Municipal Tramways Association, the Institute of Transport, the Tramways & Light Railways Association, the I.E.E., and the Association of Public Lighting Engineers.

Orders Recently Booked

The English Electric Co., Ltd., has received the contract for the extension of the power station of Slough Estates, Ltd., Slough, to the specification of their chief engineer, Mr. S. Harper Bill. The new set will be a 2,000-kW geared back pressure turbine. Steam will be at 600 lb. per sq. in. gauge at the turbine stop valve and exhausting against a back pressure of 200 lb. per sq. in. gauge. The alternator will run at 1,000 r.p.m. and generate power at 6,600 V 3 phase, 50 cycles.

Messrs. Holman Bros., Ltd., have placed an order with Birmingham Electric Furnaces, Ltd., for nine "Birlec" automatically controlled electric furnaces. This installation follows a supply of furnaces to the South African works of Messrs. Holman's subsidiary company, Holman Bros. (Pty.), Ltd.

Works Extension

To cope with the continued increase in business, extensions to the works of the Foster Instrument Co. are now in course of erection, which will provide an additional 40 per cent. manufacturing space within the next few weeks.

Members of the Bexhill Electricity Department staff during their visit to the T. C. & M. Company's works. The group includes Sir Geoffrey Clarke, managing director of the company, Mr. L. Ransom, works manager, Mr. E. A. Walsh, sales manager, Mr. R. H. Hereford, assistant sales manager, Mr. F. F. B. Wilmshurst, chairman of the Bexhill Electricity Committee and Mr. R. C. Carter, deputy chief engineer, Bexhill.

The Royal Agricultural Show

A comprehensive range of Diesel and petrol engines for supplying electricity for light and power is to be shown by Messrs. R. A. Lister & Co., Ltd., at the Royal Agricultural Society's Show which takes place at Newcastle from July 2nd to July 6th. The display will include engines suitable for all sizes of buildings, and petrol and paraffin engines for marine purposes. An agricultural exhibit, consisting of ploughs, cream-separators, refrigerators, and other dairy equipment completes the display.

Messrs. Ruston & Hornsby will be exhibiting a wide range of its products, including fuel oil engines, petrol-paraffin engines, air compressor sets, pumps and pumping plant, and a Diesel locomotive.

For Sale

Borough of Hornsey Electricity Department has for disposal reciprocating engines, generators, and other plant.

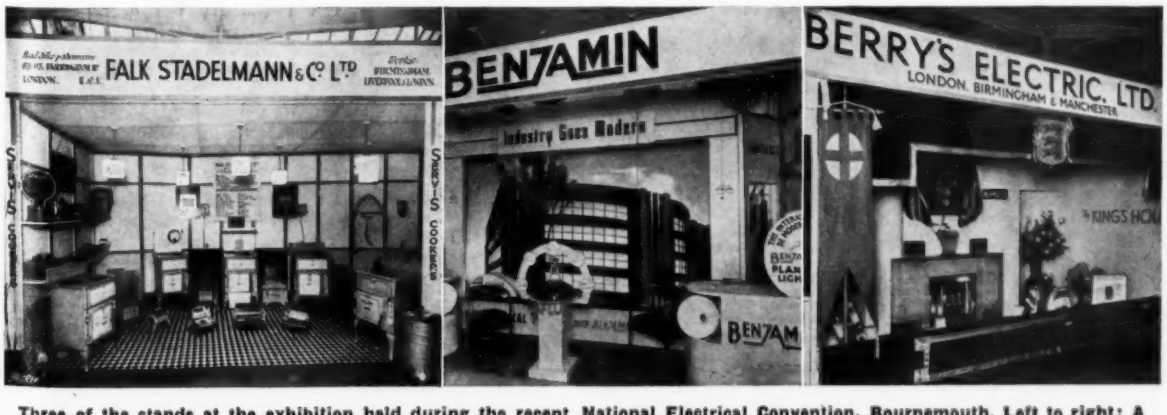
(See our classified advertisements.)

Butane Furnaces

We are asked to state that many features of the bright annealing furnace mentioned in the account of the works of Messrs. Henry Wiggin & Co., Ltd., published in the ELECTRICAL REVIEW of May 17th, page 720, are the subject of patents or patent applications for cracking and partially burning the butane, and for the chain screens for preventing undue loss of protective gas.

School Electrical Installations

New schools have recently been erected at Craigentinnag, Granton and Niddrie for the Edinburgh Corporation. The Edison Swan Electric Co., Ltd., has sent us a photograph of the first-named school, and states that over 10,000 yds. of Edison Swan "Vicma" cable were used in each school, while



Three of the stands at the exhibition held during the recent National Electrical Convention, Bournemouth. Left to right: A display of domestic appliances by Messrs. Falk, Stadelmann & Co., industrial lighting by the Benjamin Electric, Ltd., and electric fires by Berry's Electric, Ltd.

over 2,000 " Royal Ediswan " lamps have been installed. The buildings were designed by the Edinburgh city architect, and the electrical installation was carried out by Messrs. H. J. Shand & Co.

Trade Announcements

Lighting Research (proprietor, Dr. F. T. J. Firminger) has removed to 84a, Highbury New Park, N.5 (telephone : Clissold 5939).

The Direct Electric Lamp Co., Ltd., has removed to larger offices and showrooms at 80, City Road, E.C. (telephone : Clerkenwell 5546).

The Patent Switch and Fuse Indicator Co., Ltd., has removed to Woodroyd Works, 605, Manchester Road, Bradford.

Mr. E. Entwistle, Midland representative of Messrs. Belling & Co., Ltd., has removed to " Moor View," Little Aston Lane, Little Aston, Sutton Coldfield.

The " Heatlite " Combination

We are asked to state that the " Heatlite " combined heating and lighting pendant, which is particularly suitable for use in bathrooms and similar situations, is of registered design, the registration number being 799020. This unit was exhibited by Harcourts, Ltd., at the National Electric Convention, Bournemouth, and illustrated on page 825 of our June 7th issue.

Australian Tariff on Telephone Apparatus

H.M. Trade Commissioner at Sydney has reported to the Department of Overseas Trade that a request for the imposition of duties under the British preferential tariff and increased duties under the general tariff on hand-set telephones and bell boxes for use with telephones has been referred to the Australian Tariff Board for consideration and report. At present these instruments are dutiable under tariff item No. 180 A (1) free British preferential tariff and 20 per cent. *ad valorem* general tariff. United Kingdom firms desiring to oppose this proposal should communicate immediately with the Department at 35, Old Queen Street, Westminster, S.W.1.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances.

CHEMICALS, ETC.	Price, June 19th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... „	£18 10s.	—
a Borax ... ... „	£17	—
a Copper, Sulphate ... ... „	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3½d. to 4¼d.	—
a „ Perchlorate ... ... „	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a „ Roll ... ... „	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a „ Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b „ Wire ... ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil... ... „	1/2 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£207	£2 dec.
Grade II ... ... „	£142	£1 dec.
Grade III ... ... „	£72	£1 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	7d.	¼d. dec.
c „ Tubes (solid drawn) ... ... „	9¼d. to 9½d.	—
c „ Wire, basis ... ... „	7¾d.	¼d. dec.
c Copper Tubes (solid drawn) ... „	10d.	—
g „ Bars (best selected)... ... per ton	£62	£2 dec.
g „ Sheet... ... ... „		
g „ Rod ... ... „		
d „ (Electrolytic) Bars ... ... „	£35	£2 10s. dec.
d „ „ Wire Rods ... „	£40 10s.	£1 dec.
d „ „ H.C. Wire ... per lb.	6¾d.	—
f Ebonite Rod ... ... „	1/6 to 2/- plus	—
f „ Sheet ... ... „	1/3 to 1/6 10%	—
n German Silver Wire... ... ... „	2/5	—
h Gutta-percha, fine ... ... „	nom.	—
h India-rubber, Para-fine ... ... „	5d.	¼d. inc.
i Iron, Pig. (Cleveland No. 3) ... per ton	62/6	—
i „ Wire galv. No. 1, P.O. Qual... „	£20	—
g Lead, English Pig ... ... „	£15 10s.	5s. dec.
g Mercury ... ... per bot.	£11/7/6 to £11/17/6	—
e Mica (in original cases) small ... per lb.	6d. to 1/-	—
e „ „ medium ... „	5/- to 10/-	—
e „ „ large ... „	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... „	1/1	—
p „ „ drawn bars & rods „	11¼d.	—
p „ „ rolled strip & sheet „	10¾d.	—
p „ „ wire ... ... „	11¼d.	¼d. dec.
e Platinum ... ... per oz.	£7	—
d Silicum Bronze Wire ... ... per lb.	7¼d.	¼d. dec.
r Steel, magnet, in bars ... ... „	7¼d.	—
g Tin, Block (English)... ... ... per ton	£228	£1 15s. inc.
n „ Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicum bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notes" under the same heading.

Radio Apparatus Production in Czechoslovakia

The fourteen largest manufacturers of radio apparatus in Czechoslovakia have entered into an agreement for the regulation of the production and sale of radio apparatus, provisionally for one year ending July, 1936.

Social Events

For the first time for many years, the annual athletic sports meeting of London establishments of the General Electric Co., Ltd., which were held on Saturday last, took place in weather which threatened to spoil the meeting. Fortunately, heavy rain held off until nearly the close, and despite the threat of storms there was the usual large crowd of spectators who were well rewarded by an afternoon of many close contests. Lord and Lady Hirst, who take a keen interest in these meetings were present, while others who attended were Sir William and Lady Noble, Dr. A. H. and Mrs. Railing, Mr. Edward Hirst (managing director of the British General Electric Co., of Australia), Mr. C. Wilson and other directors. One of the chief trophies of the meeting was the Leslie Gamage trophy for the leading London establishment, which was won by head office, the runners-up being Osram Works. As in

Lord Hirst (seated), Sir William and Lady Noble and Mr. Edward Hirst (on the right) at the G.E.C. sports

previous years, there were numerous side shows which attracted a continual stream of visitors. At the conclusion of the events the prizes were distributed by Lady Hirst, and in response to a vote of thanks to her proposed by Mr. W. Warren, chairman of the sports committee and manager of the Union Works, Wembley, Lord Hirst made a brief speech which was received with enthusiasm.

The Crompton Parkinson Sports Club held its forty-fourth annual meeting on Saturday, June 15th, at Chelmsford. In spite of bad weather the whole programme of thirty-three events was carried through, and some excellent performances were put up by the 130 competitors who took part. At the conclusion of the meeting Col. R. E. Crompton, the patron of the club, presented the prizes.

New Catalogues and Lists

Samuel Baxter, Thames Factory, Rainville Road, W.C.—We regret that last week, in mentioning a leaflet on the " Beryl " motor blower and grinder and polisher, we incorrectly gave the maker's name as Samuel Barker.

British Insulated Cables, Ltd., Prescot, Lancs.—" Rockbestos " magnet wire, paper pinions, and arc light and projector cables are all dealt with in new pamphlets.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has sent us a leaflet on street and industrial lighting applications of " Osira " electric discharge lamps.

Elliott Brothers (London) Ltd., Century Works, Lewisham, S.E.13.—Catalogue sheets D 145/148 dealing with maximum demand recording ammeter.

Brook Motors, Ltd., Huddersfield, has sent us a booklet giving the reductions in the price of electric motors.

D. M. Lumsden, Millburn, Almondbank, Perth.—An illustrated brochure on quartz mercury lamps for ultra-violet radiation.

R. Cadisch & Sons, Red Lion Square, W.C.1, have issued a 172-page illustrated side-lines catalogue.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A folder dealing with thermo-electric pyrometers.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—A leaflet on Sturtevant forges.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 931 describing electrical thermal storage with low-voltage electrode water-heaters.

Bankruptcy Proceedings

A. E. Poole and **H. Marsters,** carrying on business in partnership as " Poole's," 33, Union Street, Wednesbury, Staffs, electrical engineers.—These debtors attended at the Court House, Lichfield Street, Walsall, recently, for their public examination. Their joint statement of affairs showed gross liabilities of £702, of which £657 was expected to rank for dividend. The assets were estimated to produce sufficient to provide a surplus of £469. The debtor, A. E. Poole, stated that he commenced business in 1922 and was joined by Marsters in 1927. The premises at Union Street, Wednesbury, were purchased for £800. For some years an average net profit of

between £500 and £600 per annum was made. In November, 1933, one of the debtors' employés who was driving a motor van was involved in an accident and an action for damages was commenced. That contributed to the present position. The debtor, Marsters, confirmed the evidence given, and the examination was adjourned.

F. Stead, 1, Manchester Square, Otley, wireless dealer.—The receiving order herein was made on the debtor's own petition recently and the statement of affairs filed in the proceedings disclosed liabilities of £295 and assets of £142.

J. Cameroff (J. Cameron), electrical engineer, 43, Camp Road, Leeds.—First meeting June 21st at 24, Bond Street, Leeds. Public examination, July 9th at the County Court House, Leeds.

J. L. Gottlieb, wireless manufacturer, 28, Danulf Road, Hampstead.—Application for discharge to be heard at Bankruptcy Buildings, Carey Street, W.C., on July 4th.

F. G. H. Rockall (Rockall & Co.), electrical engineer, 7-8, Ham Yard, Piccadilly, W.—Application for discharge to be heard on July 2nd at Bankruptcy Buildings, Carey Street, W.C.

R. J. Heath (Whitchurch Radio Service), 3, Brownlow Street, Whitchurch.—Trustee, Mr. F. E. Bendall, 3, Warwick Passage, Corporation Street, Birmingham, appointed June 7th.

G. Y. Entwistle, electrician, 63, Shorey Bank Yard, Darwen.—Trustee, Mr. J. W. Carter, District Bank Chambers, Blackburn, Official Receiver, released May 30th.

J. R. Durber (Durber Bros., Red Lion Square, Newcastle-under-Lyme, and City Electrical Supplies, 183, London Road, Stoke-on-Trent), electrical engineer.—Trustee, Mr. P. M. Milward, 12, Lonsdale Street, Stoke-on-Trent. Official Receiver, released May 30th.

A. Wolstenholme, electrical engineer, 26, Bridge Street, Swinton.—Trustee, Mr. L. J. Clegg, 14, Figtree Lane, Sheffield, Official Receiver, released May 21st.

H. C. Vanson, electrical engineer, 35, Pasture Road, Goole.—Trustee, Mr. B. S. Briggs, 13, Burton Street, Wakefield, Official Receiver, released May 29th.

C. Worden, electrical engineer and radio dealer, 5, St. Albans Road, Darwen.—Last day for receiving proofs for dividend June 28th. Trustee, Mr. A. H. Ward, District Bank Chambers, Blackburn, Official Receiver.

W. C. Stephenson, wireless dealer, 1, Barnfield Road, Spennymoor.—Last day for receiving proofs for dividend July 3rd. Trustee, Mr. W. A. Ellis, 32, Frederick Street, Sunderland, Official Receiver.

Company Liquidations

Whittingham, Smith & Co., Ltd., radio manufacturers, Portadyne Works, Gorst Road, North Acton, London, N.W.10.—The creditors of the above met on June 17th at the Holborn Restaurant, London, W.C. The statement of affairs showed ranking liabilities of £26,025. The assets were set down at £20,456, and were subject to debentures and preferential claims of £4,198. The net assets, therefore, were £16,259, or a deficiency, so far as the creditors were concerned, of £9,766. It was reported that the company was registered in April, 1932, with a nominal capital of £100, which was subsequently increased to £500. The company took over an existing business, and the shares which were issued for cash were, in fact, utilised in payment of the assets taken over. For the years ended March, 1932, 1933 and 1934, net profits were shown. The accounts for the year to March last were not completed, but the turnover in that period was about £111,000. Since March of the present year there had been a heavy fall in the sales. On May 27th last an informal meeting of the principal creditors was held, when a committee was appointed. That committee had since conferred with the directors, but the latter had not been able to submit proposals which the committee thought would be acceptable to the creditors generally. An execution had also been levied and a receiver appointed for the debenture holder. It was then decided that voluntary liquidation should take place. Resolutions were passed confirming the voluntary liquidation of the company with Mr. C. Latham, of 78, New Oxford Street, London, W.C., and Mr. W. A. J. Osborne, of Balfour House, Finsbury Pavement, London, E.C., as joint liquidators, with a committee. The principal creditors are:—British Rola Co., Ltd., £1,469; Ercolani & Sons, Ltd., £1,057; J. Lucas, Ltd., £590; Mullard Wireless Service Co., £3,470; Standard Telephones & Cables, Ltd., £614.

Midland Crystal Light, Ltd., electric lamp suppliers, Ocean Chambers, Waterloo Street, Birmingham.—At a meeting of creditors a statement of affairs was presented showing ranking liabilities of £372. The net assets were £18, leaving a deficiency, so far as the creditors were concerned, of £355. The issued capital was £1,305 and the deficiency as regarded the shareholders was thus £1,660. The company was registered in May, 1934, and the present position was attributed to heavy initial expenditure in developing agencies for the sale of lamps. Owing to the inability of the company to continue trading the benefit of that expenditure would not now be obtained. It was further stated that certain of the lamps supplied in the early stages were faulty, which led to a large number being returned. Resolutions were passed confirming the voluntary liquidation of the company with Mr. H. J. Gittings, of Messrs. Kimberley, Morrison & Co., as liquidator.

Car Electrical Maintenance Co., Ltd.—Winding up voluntarily. Liquidator, Mr. E. F. Wilkins.

Spanish Telephone Co., Ltd.—Particulars of claims by July 6th to the liquidator, Mr. H. E. Monson, 64, Coleman Street, E.C.

E. Marson, Ltd.—Particulars of claims by June 25th to the liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Pettie & Co. (Electrical Engineers), Ltd.—Meeting July 26th at 34, Castle Gate, Nottingham, to receive an account of the winding-up by the liquidator, Mr. T. E. Clarke.

Private Arrangement

Olympia Radio, Ltd., Manchester.—A conference of the creditors of the above was held recently, having been convened by Mr. J. W. Shepherd, of 78, King Street, Manchester, the receiver for the debenture holders. A balance sheet was submitted as at April 18th last, the date of the appointment of the receiver, and it showed total liabilities of £25,343. The assets totalled £21,286. The receiver stated that he had a considerable quantity of assets to dispose of and he was endeavouring to sell the majority of the thirteen branch shops as going concerns. It was decided that a committee of three of the principal creditors should be appointed to co-operate with the receiver in the realisation of the assets.

Steam Raising in the Dairy

THE steam and hot water required in every dairy for sterilising, pasteurising, and washing up, have, until recently, been provided principally by the combustion of fuel in or near the dairy premises, thus considerably increasing the difficulty of maintaining cleanliness. One of the dairy workers has usually to leave his work to stoke the boiler. He returns with dirt on his fingers and dust on his clothes, the grime finding its way into the milk or the utensils; further, milk has a great propensity for absorbing odours.

To the cost of fuel and capital charges must be added expenditure incurred in fuel handling and cartage, attendance, and boiler maintenance. Moreover, frequent cleaning of the walls, ceilings and floors is also called for. These items are eliminated or rendered almost negligible by the employment of electricity for the production of steam and hot water.

The 20-kW electrode steam-raiser illustrated is manufactured by Messrs. A. Reyrolle & Co., Ltd., and can raise steam to a pressure of 25 lb. per sq. in. from cold in less than five minutes after switching on. Its full output is 60 lb. of steam per hour and the maximum cost of energy at ½d. per kWh is 10d. an hour. With a 30-cu. ft. unlagged cabinet containing milk-bottles in crates, current is required for only 35 min., costing approximately sixpence for each sterilisation. The steam fittings include a pressure gauge, safety valve, steam-control valve, and water gauge.

The maximum steam output of steam-raisers having the same external dimensions as that shown can be adapted on site by varying the size of the electrodes, for duties between 30 and 100 lb. per hour. The loading can be reduced by altering the height of the water-level, which can be observed in the gauge-glass. Water is injected into the shell by a hand-pump, and, if steam is required over a considerable period this may be done automatically by the addition of a simple controlling device.

Immersion Type Steam Raisers

Steam-raisers of the immersion type are also obtainable in a wide variety of sizes. These consist of a riveted or welded shell, fitted with one or more tubular immersion-heaters, in the containers of which resistance wire is wound on insulators. A Reyrolle steam-raiser, containing three immersion heaters giving a total loading of 12 kW and a steam output of about 30 lb. per hr. is in use on a dairy farm carrying 45 cows in milk. It operates at 60 lb. per sq. in. and supplies all the steam and hot water required in the dairy.

The utensils to be sterilised consist of a number of 10-gal. churns, milking machine pails with lids and tubes, a cooler,

A 20-kW Reyrolle electrode steam raiser

a receiving-pan, brushes, cloths, a plunger, and numerous small utensils. These are sterilised once a day in a 48-cu. ft. lagged cabinet, the temperature of which rises to 210 deg. F. about 10 min. after the current is switched on. Approximately 10 gal. of hot water are used twice a day for washing up. The daily consumption for these services is approximately 20 kWh.

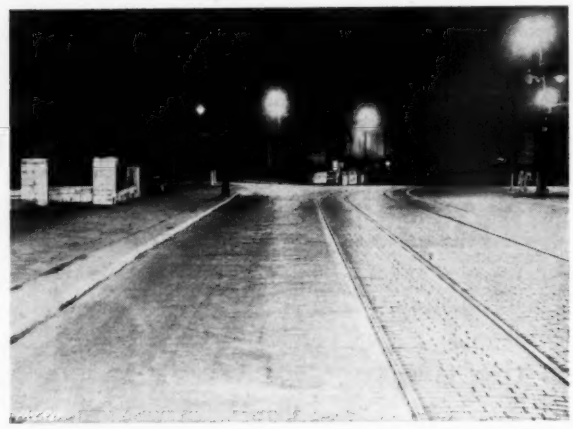
Electricity Supply

Lighting, Domestic, Power

Acton.—SUB-STATION.—The Metropolitan Electric Supply Co., Ltd., is to erect a sub-station in Atlas Road.

Australia.—NEW SOUTH WALES DEVELOPMENT SCHEME.—Mr. Spooner, the New South Wales Minister for Local Government, is convening a meeting of representatives of South Coast local authorities to consider an important scheme of electricity development. All the necessary supply is available at Port Kembla, and it is proposed to extend the system to thousands of farms and homes where at present electricity is not available. It is considered that with a lead from the Government and with a financial contribution towards the cost of distribution the whole of the South Coast area could be electrically co-ordinated and supplied within a year or so.

PREPARING FOR EXTENSIONS IN VICTORIA.—The engineers of the Victoria Electricity Commission are preparing plans for important generating plant extensions which may cost up to £2,000,000. The main alternatives are additions to the Yallourn or Newport power stations, the Sugarloaf-Rubicon hydro-electric system and the establishment of a hydro-electric system on the Kiewa River, while the possibilities of a hydro-electric scheme on the Mitta River, operating in conjunction with the Hume reservoir, are also being investigated. It is felt that the extension of the hydro-electric system would ensure continuity in the supply of electricity should there be failure in the operation of stations relying upon coal. Plans aggregating 250,000 h.p. have been tabulated for consideration when important additions become necessary. The Yallourn station has at present an effective capacity of 97,000 kW. A 25,000-kW generator is now being installed, and provision has been made for another to be added when it is required.



Old Christchurch Road, Bournemouth, illuminated by 400-W "Mazda Mercra" lamps in "H" lanterns during the recent National Electrical Convention

Bangor.—LOWER CHARGE.—In view of the fact that there was a net revenue balance of £2,292 on the working of the electricity undertaking during 1934-35, as compared with a loss for the preceding year, the City Council has decided to reduce electricity charges, and the new rates are as follows: First 500 kWh per quarter for lighting, 5½d. per kWh; second 500 kWh at 5d.; next 500 kWh at 4½d.; 1,500 to 2,000 kWh at 4d.; all in excess of 2,000 at 3½d. per kWh; slot meters, 6d. per kWh, inclusive of meter rent; cooking, 1d. (1½d.) per kWh; power is reduced by ½d. per kWh on the present scales.

Batley.—ASSISTED WIRING.—The Town Council is to spend a further £2,000 out of revenue on assisted-wiring work.

Battle.—OVERHEAD LINE EXTENSIONS.—The Rural District Council has consented to the Weald Electricity Supply Co., Ltd., erecting overhead lines for supplying electricity to Ticehurst. In addition, overhead lines at Heathfield are being extended to Burwash and Etchingham.

Bognor Regis.—RURAL EXTENSIONS.—The Bognor Gas and Electricity Company has just completed an overhead extension to Pagham, its farthest outlying area, which includes a spur line to the old Parish church. Only part of Pagham Beach has been provided with a supply owing to opposition to overhead lines.

Bridport.—CHEAPER ELECTRICITY.—The Town Council has announced the following modified charges: Flat rate for lighting reduced by ½d. per kWh, and power and heating by ½d. Cooking is to be charged the same as for water heating, namely, 1d. per kWh (1½d. in the outer area). In the domestic tariff the first charge is to be reduced by 5 per cent.

Carlisle.—EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £6,746.

Ceylon.—SUPPLY SCHEMES.—According to the *Far Eastern Review*, work in connection with the establishment of sub-stations at Kandana and Jaela is now in progress. The h.v. main from the Kolonnawa power station supplying Negombo is to be utilised for branch services, while from Kelaniya distribution mains are being laid to Peliyagoda to provide a supply in place of that from the existing oil-engine plant of the Peliyagoda Sanitary Board.

Chanctonbury.—OVERHEAD EXTENSION.—The Rural District Council has, subject to the approval of the West Sussex County Council, given permission to the Steyning Electric Light Co. to erect a l.v. overhead distributing line at Spear Hill, Ashington.

China.—SHANSI POWER SCHEME.—According to *Eastern Engineering and Commerce*, plans on a large scale are being prepared by the Pacification Commissioner of Shansi for harnessing waterfalls in southern Shansi to work 500 small hydro-electric plants. The scheme is estimated to cost $5,000,000.

Droxford.—LOWER CHARGES.—The Portsmouth Corporation has reduced the flat rate for lighting in the area of the Rural District Council from 6d. to 5½d. per kWh in the summer (a ½d. extra is charged in winter), and the "unit" charge on the domestic and maximum demand tariffs from 0.75d. to 0.65d. per kWh during the winter, the summer charge remaining at 0.5d. per kWh.

Edinburgh.—REDUCED TARIFF.—A reduction in the charges for electric lighting from 3½d. to 3d. per kWh has been recommended by the Electricity Committee. This will affect all consumers, and those with prepayment meters will get a rebate of 2d. in the shilling instead of 1d., as formerly.

Gillingham (Kent).—SUPPLY PROJECTS.—Subject to the Kent Agricultural Committee making guaranteed contributions for two years the Town Council is to give a supply of electricity to the Spade Lane district at a cost of £200. A Fringe Order will be applied for, together with another for a section of the Maidstone Road, both being within the borough but in the area of supply of the Kent Electric Power Co.

Glasgow.—NEW CABLES.—It is proposed to lay five additional 20,000-V main transmission lines at an estimated cost of £80,000 (cables, &c., £61,000, and switchgear, &c., £19,000), and the Electricity Committee has received sanction to the borrowing of that amount. Distributing mains are to be laid at a cost of £46,342.

Great Britain.—CONSUMERS of Electricity.—On June 18th, Mr. H. Williams asked the Minister of Transport if he could state the present number of consumers of electricity and, for comparison, the number in 1919. Captain Hudson said that the official returns of the Electricity Commissioners showed that there were upwards of 6,600,000 consumers at the end of 1934, as compared with 2,600,000 at the end of 1927-28. It was computed that there were some 750,000 consumers in 1919, although no official figures were available.

Hastings.—MAINS AND PLANT.—The Electricity Committee is to borrow £5,955 for mains and £4,650 for plant in connection with the supply to the tramways company. Mains are also to be extended at a cost of £794 to supply premises in Hurst Lane, Sedlescombe.

Hazel Grove and Bramhall.—FREE ELECTRIC IRONS.—Until further notice the Electricity Committee is to present every new consumer on the lighting tariff with an electric iron.

India.—MYSORE.—The maximum capacity of the Sivasamudram hydro-electric installation has been reached and new schemes are being considered. These include the harnessing of the Jog (Gersoppa) Falls, the Krishnarajasagara Falls and the Lakkavalli project on the Tungabhadra River. Mr. S. G. Forbes, formerly chief electrical engineer to the State, has been recalled in a consulting capacity and is now in Bangalore.

COCHIN.—Considerable industrial expansion is apparent and negotiations are proceeding with the neighbouring State of Travancore for an electricity supply in bulk. Failing an agreement being reached steam-operated power stations may be started pending the completion of a hydro-electric plant.

PUNJAB.—New power stations have been completed at Kamal and Okara.

Llandrindod Wells.—REVISED CHARGES.—A copy of the revised tariffs in the area of the Electricity Department has been sent to us by Mr. C. C. Wilde, the engineer and manager. The lighting rate varies from 6d. to 4d. per kWh where more than 2,000 kWh is used per quarter, while the heating and cooking flat rate is now 1½d. per kWh. For both the residential and business, two-part tariffs the new "unit" charge is 1½d. per kWh, while through prepayment meters 7½d. per kWh is charged for lighting and 1½d. per kWh for cooking, there being no meter rent. There are special rates for outdoor lighting.

Kendal.—STRICKLAND KETCH.—The Westmorland & District Electricity Supply Co., Ltd., is applying for sanction to erect a 11-kV overhead line at Strickland Ketch. The Town Council is to raise no objection.

Lancing (Sussex).—STREET LIGHTING.—Negotiations are proceeding between the Parish Council and the West Sussex County Council regarding a scheme for electric street lighting estimated to cost £1,150.

Lichfield.—NEW FLAT RATE.—The City Council has decided that where electricity is used in dwelling houses for cooking and heating the flat rate will be 1d. per kWh, irrespective of the rateable value of the house.

London.—BATTERSEA.—The Electricity Committee is to provide supply to ninety premises at a cost of £674.

STOKE NEWINGTON.—A new a.c. main is recommended by the Electricity Committee to be laid in the Brownwood and Blackstock Roads area.

FLOODLIGHTING SCHOOL PLAYGROUNDS.—In order to keep children from playing in the streets the London County Council has decided to floodlight school playgrounds after dark during the winter on the evenings when the weather will permit the playing of games. Illumination for two hours, three nights a week from October to March is estimated to cost £90.

Lowestoft.—LOAN.—Sanction has been received to a loan of £3,500 for mains and plant.

Newcastle Emlyn.—SUPPLY EXTENSION.—The West Cambrian Power Co. is to erect overhead lines between Pencader and Carmarthen. Development of this kind is being encouraged by the Rural District Council.

Stonehouse.—OVERHEAD LINE.—The Gloucestershire County Council has granted an application by the West Gloucestershire Power Co. for permission to erect an overhead line at Stonehouse, provided that the cables are laid underground as far as Woodcock Lane and afterwards continued as an overhead line placed behind houses so as not to interfere with the amenities of the village.

Straits Settlements.—CHURCH LIGHTING AT PENANG.—St. George's Church, Penang, one of the oldest ecclesiastical buildings in the country, has been rewired and a new lighting system installed by the Singapore branch of the General Electric Co., Ltd. The result is that while the lighting is much improved, as can be seen from the comparative illustrations on this page, the maintenance costs are reduced by 25 per cent.

Taunton.—A GRID SUPPLY.—Arrangements have been made with the Central Electricity Board for a grid supply to be made available, and the Corporation is to install at its generating station plant to convert the supply from a.c. to d.c., the capital charges (approximately £2,750) being repaid by the Board.

The old and new systems of lighting at St. George's Church, Penang

Norwich.—SUB-STATION.—The Electricity Department is to erect a sub-station in Northumberland Street.

Osmotherley.—ELECTRICITY SCHEME.—The North-Eastern Electric Supply Co. has submitted to the Parish Council a scheme for supplying electricity to the village.

Plympton.—CHEAPER ELECTRICITY.—The Rural District Council has decided, on the recommendation of the Electricity Committee, to reduce the charge for lighting from 7d. to 5½d. per kWh as from October 1st next.

SUPPLY TO ESTATES.—The h.v. main at Crownhill is to be extended to Honicknowle and St. Budeaux for the purpose of supplying certain building estates in the course of development, at an estimated cost of £1,800.

Russia.—E.H.V. DISTRIBUTION.—According to the *Electrotechnische Zeitschrift* a scheme for the establishment of an electricity distribution grid throughout Russia is at present under consideration. As it is considered necessary for the supply to be at about 400,000 V the Institute of Electro-Physics, of Leningrad, has been authorised to proceed with the erection of a short experimental line capable of transmitting power up to 500,000 V in order to secure data as regards the most suitable types of conductors, insulators and protective devices.

Spalding.—SUB-STATION.—The Urban District Council is to lay an underground h.v. cable to a new sub-station on the Willesby Road housing site at an estimated cost of £3,500.

Standish (Lancs).—ELECTRIC LIGHTING PREFERRED.—Application has been made for a loan of £740 for converting a number of street lamps from gas to electricity.

Torquay.—SUPPLY AREA.—The Town Council is making application to the Electricity Commissioners for an Order to enable the Corporation to extend its area of supply for electricity purposes to include the district transferred to the borough under the Devon Review Order, 1935, and the parishes of Stoke-in-Teignhead and Haccombe-with-Coombe in the Rural District of Newton Abbot, and to purchase the existing electricity undertaking in those areas.

Tynemouth.—LOAN.—The Electricity Committee has obtained sanction to borrow £10,000 for mains and services.

Uttoxeter.—ORDER GRANTED.—The Electricity Commissioners have made an Order permitting the Trent Valley & High Peak Electricity Co. to supply further consumers at Abbots Bromley.

Walton and Weybridge.—CABLE-LAYING.—The Urban District Council has decided that at the expiration of the present contracts it will carry on the laying of l.v. cable by direct labour for an experimental period of a month.

Warrington.—SUPPLY EXTENSION.—The Electricity Committee is seeking permission to provide supply to the Cherry Lane area of the Lymm Urban District Council.

Wick.—LOAN.—The Town Council has decided to borrow £4,500 for plant and machinery (sub-station equipment) and £1,500 for mains.

Wolverhampton.—SUB-STATION.—The Electricity Committee is to provide a dual-purpose sub-station in Dudley Road at a cost of £2,816.

CHANGE-OVER.—A change-over is to be effected in the Vicarage Road area, Penn, at a cost of £961.

EXTENSIONS.—The Electricity Committee is to extend mains to Donnington at a cost of £569 and to Penn (£4,385).

Electrical Progress in Nigeria

THE annual report of the electrical branch of the Public Works Department for 1934 shows that the amount of electricity sold by the undertakings at Lagos, Port Harcourt, Kaduna and Energu was 6,934,354 kWh as compared with 5,788,854 kWh during 1933. Here, as in our own country, the introduction of hire schemes for cookers has met with considerable success. Electric fans have achieved a large measure of popularity, and many were installed during the year. Another step forward was the development of a boiling ring specially adapted to the needs of the small African consumer.

Rigorous testing of installations in Lagos has been made necessary by the more general use of foreign wiring materials of poor quality, and this was partly responsible for a decrease in the number of new consumers. Nevertheless, the number rose from 3,676 at the end of 1933 to 4,299, the average consumption per head being 415 kWh. A considerable amount of domestic apparatus was purchased for the showroom and E.D.A. literature distributed, with the result that there was a definite increase in the use of various domestic electrical apparatus.

At Port Harcourt the increase in consumers was only 39, bringing the total to 686 with an average consumption of 207 kWh. On the other hand, at Kaduna the total of 570 consumers included 144 connected during the year, but the average consumption was only 133 kWh. The report states that assiduous canvassing has proved the best method of obtaining consumers. At the end of the year there was a waiting list for the hiring out of domestic apparatus. At Energu there were, at the end of the year, 1,138 consumers (an increase of 302), the consumption per head being 155 kWh.

Traction

Bournemouth.—NEW TROLLEY-BUS ROUTE.—A further trolley-bus route has been inaugurated between The Square and Winton and Moordown.

Germany.—RAILWAY ELECTRIFICATION.—The work of electrifying the Dittersbach to Glatz section of the German State Railways is about to be put in hand.

Great Britain.—SOUTHERN RAILWAY PLANS.—Electrification schemes to enable through electric trains to be run from London to Portsmouth and to Weybridge and Woking are being considered by the Southern Railway.

LONDON TRANSPORT SCHEME.—On Tuesday a memorandum on the proposed financial resolution for the London Passenger Transport (Agreement) Bill, 1935, was issued, with an agreement in the form of a White Paper (Cmd. 4929). The proposed resolution authorises the introduction of a Bill empowering the Treasury to guarantee the payment of the principal of a loan not exceeding £40,000,000, together with interest thereon, to be raised by a company to be formed by the Treasury for the purpose of lending the necessary moneys to the transport undertakers. It is not anticipated that any charge will fall on the Exchequer. The agreement provides that the works, details of which appeared in the ELECTRICAL REVIEW of June 14th, shall be completed within five years from September 30th, or within such further period as the Minister of Transport may allow. It is stated that all plant, machinery and materials required shall, so far as is practicable, be of United Kingdom origin.

On June 15th in the House of Commons Mr. G. Strauss asked the Minister of Transport whether, under the proposed London Passenger Transport improvement schemes, regard would be had to the claims of the South-Eastern district of London for greater tube facilities. Captain A. Hudson (Parliamentary Secretary to the Ministry of Transport) replied that the electrification of the Southern Railway had improved the travelling facilities in South and South-East London, and the London Passenger Transport Board had informed him that in these circumstances they considered that other areas not so well served were more in need of improvement.

Italy.—ELECTRIC RAILWAYS.—According to the recently issued annual report of the Italian State Railway authorities for 1933-34 the length of the electrified portions of the Italian railway system at the end of that period amounted to 1,364 miles, which is 57 miles more than a year ago.

Communications

Bolton.—TELEPHONE TENDERS.—The Corporation is to invite quotations for the installation of an internal telephone system at the civic buildings.

Great Britain.—POLICE RADIO.—The need for properly organised police wireless systems was pointed out at a recent conference of the Chief Constable's Association. Mr. F. C. Johnson, of the Home Office, foreshadowed the division of counties into areas, the forces in each of which would rely upon a central transmitter capable for covering the whole area. Recent experimental work, he said, had shown that such a scheme was now quite practicable. He thought that eight regional stations should suffice if morse were used, but not for telephony.

RADIO LICENCES.—Last month 355,440 wireless licences were issued, bringing the total number in force up to 7,092,596, an increase of 753,035 compared with the number at May 31st, 1934.

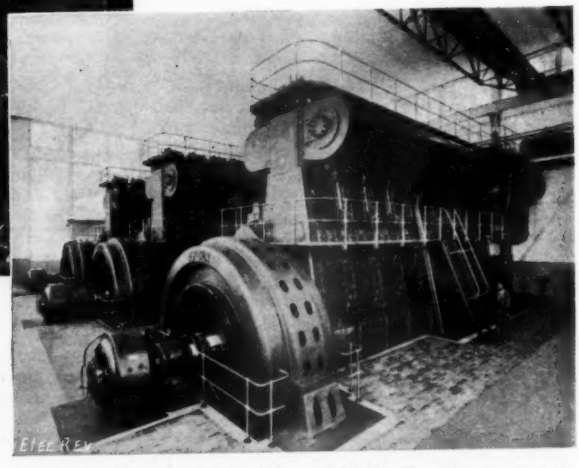
Hastings.—RADIO INTERFERENCE.—The Transport Committee has appointed a sub-committee to investigate means of remedying radio interference by trolley-buses.

Malaya.—BROADCASTING SERVICE.—It is reported in *Eastern Engineering and Commerce* that British Malaya Broadcasting Corporation, Ltd., a new venture, proposes to erect a 2-kW medium-wave transmitter in Singapore at a cost of $63,000.

Monaco.—TELEPHONY.—The Government is reported to have entered into an agreement with the Compagnie Générale de Télégraphie de Téléphonie de Paris for the establishment of a system of automatic telephony by January 1st, 1936. A company is to be formed to operate the system for twenty-five years.

Water Power with Diesel Standby

IRREGULARITIES of production arising from variation of water supply or other causes have been avoided at the Saint Gallen Appenzell works in Switzerland by the construction of peak-load and standby plant driven by Sulzer Diesel engines. Three double-acting two-cycle engines of 7,400 b.h.p. each are coupled to 5,000-kW Oerlikon generators in a building alongside the Kubel power station, the switchgear being near that of the hydro-power plant. With a total capacity of 22,000 b.h.p., this Diesel-electric plant is probably the largest in Europe.



The St. Gallen Appenzell plant: Exterior view with fuel oil tanks in the background, and (right) the Diesel standby plant

The engines have eight cylinders of 23.62-in. bore and 39.37-in. stroke, developing 8,500 b.h.p. on overload at a speed of 187 r.p.m. The engine and the pistons are water-cooled, and even when running on overload are never too hot to be touched with the hand. The fuel oil passes through filters into the oil pumps of the engines, which work at a pressure of 400 to 600 atmospheres, according to the load.

The lubricating oil is kept under pressure by means of an electrically driven pump. In order to be able to start the main engines when there is no current available an emergency installation runs on the compressed air used for starting. While running, the engine operates its own lubricating pump.

The cooling water is taken from the tail race of the hydro-electric station nearby by three pumps, and in an emergency the main engines can be started without first starting the cooling water pumps. Tests have shown that it is possible to get the first set running within 1½ minutes and the whole plant can be brought from rest to full load in 5 minutes.

The Generators

The generators are of the change-pole type. The rotor is keyed on to the shaft, which is rigidly coupled to the engine shaft. The normal continuous output of the generators is 6.250 kVA each at 10,700 V, 50 cycles, when running at 187 r.p.m. The stator windings are insulated for a test voltage of 22,400 V. The rotor acts both as an induction wheel and also as a flywheel for the Diesel engine. While only 15 per cent. overload was required by contract, the installation, on test, was able to stand up for short periods to 25 per cent. overload, amounting to 9,250 b.h.p.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Ashford.—June 26th. U.D.C. Electrical pumping plant and level and flow recording apparatus. Surveyor, 5, North Street (deposits £1 1s. in each case).
July 8th. Electricity Department. Underground cables. (See this issue.)

Berwickshire.—July 1st. County Council. Various works, including electrical, at the new High school, Eyemouth. R. Wood, director of education, Education Offices, Duns.

Bexley.—June 29th. U.D.C. Cables. (June 14th.)

Birmingham.—July 5th. Electric Supply Committee. E.h.p. 11,000-V 50-cycle metal-clad switchgear. (See this issue.)
Electricity Department. July 4th. E.h.p. metal-clad switchgear. (See this issue.)

Brighouse.—July 15th. Corporation. Wiring of houses under the hire-purchase wiring scheme during the year ending August 31st, 1936. Electrical engineer, Huddersfield Road.

Cannock.—July 1st. Electricity Department. Meters. (See this issue.)

East Lothian.—County Council. Electrical heating and lighting work at Knox Institute, Haddington. County architect, County Buildings, Haddington.

Egypt.—August 15th. Mechanical and Electrical Department, Ministry of Public Works. Transmission line between the Bosseili and Rosetta pumping stations. Chief inspecting engineer, Egyptian Government, 41, Tothill Street, S.W.1. (deposit £1 0s. 6d. not returnable.)

Finchley.—July 9th. Borough Council. Street fire alarm system. (See this issue.)

Grimsby.—June 28th. Electricity Department. 11-kV and 6.6-kV cables. (See this issue.)

Hoylake.—June 29th. Electricity Department. H.p. and l.p. cables and meters. (June 14th.)
Electricity Department. July 4th. E.h.p. metal-clad switchgear. (See this issue.)

Hyde.—June 22nd. Corporation. Two electrically driven pumping sets. R. Rose, town clerk, Town Hall.

India.—Bombay, Baroda and Central India Railway Co. June 26th. Track bonding materials. (June 14th.)
SIMLA.—August 24th. Indian Stores Department. Supply of electric lamps required during the period from November 1st, 1935 to October 31st, 1936. (A.Y. 13124.)*

Keighley.—July 3rd. Electricity Department. Transformers, motors and h.p. consumers' equipment. (See this issue.)

Lancashire.—July 5th. County Council. Two electric bed lifts at Kirkham Institution, nr. Preston. S. Wilkinson, County Offices, Preston (deposit £2).
County Council. July 6th. Electric lighting to the extensions of Eccles secondary school. County architect, County Offices, Preston (deposit £5) by June 22nd.

Leeds.—July 9th. Corporation Electric lighting and provision of emergency lighting plant at the Victoria Hall, Town Hall.—W. Towers, director of City buildings, Town Hall.

London.—COMMISSIONERS OF H.M. WORKS.—June 27th. Storage batteries. (June 14th.)

Maldens & Coombe.—June 24th. U.D.C. Street lighting. (June 7th.)

Manchester.—June 29th. Electricity Committee. A.c. 15,000-V testing equipment and one mercury-arc rectifier equipment. (June 7th.)
July 5th. Public Health Committee. Electrical equipment and the changing-over of the d.c. supply to a.c. at the Colony, Langho. Medical Officer of Health (Technical Section), Sunlight House, Quay Street.

Middlesex.—July 24th. County Council Electrical work at the County Sanatorium, Harefield. (See this issue.)

New Zealand.—WELLINGTON.—August 1st. Post and Telegraph Department. P.b.j. wire. (A.Y. 13103.)*
August 2nd. Telephone cable. (A.Y. 13094.)*
August 5th. L.c. telephone cable. (A.Y. 13096.)*
August 6th. Junction blocks for telephone cables. (A.Y. 13109.)*
August 8th. Porcelain insulators. (A.Y. 13100.)*
August 12th. V.i.r. wire. (A.Y. 13095.)*
August 15th. V.i.r. multiple twin telephone cable. (A.Y. 13126.)*
August 20th. 3,000 automatic telephone dials. (A.Y. 13105.)*
August 21st. 15,000 terminal and leading-in insulators. (A.Y. 13127.)
Public Works Supply and Tenders Committee. September 17th. Electric passenger and goods lift. (A.Y. 13114.)*

Reigate.—July 5th. Electricity Department. H.p. cables and electric lamps. (See this issue.)

Saltcoats.—(AYRSHIRE).—June 28th. Town Council. Electric lighting at housing estate. H. Thomson & Sons, architects and surveyors, 60, Hamilton Street.

South Africa.—JOHANNESBURG.—Railways and Harbours Administration. July 29th. 15-ton electrically driven jib crane. (A.Y. 13101.)* Fog signalling equipment for Cape Receiffe lighthouse. (A.Y. 13120.)*
ELECTRICITY SUPPLY COMMISSION.—August 8th. Eight substation equipments, comprising h.p. switchgear, mercury arc rectifying plant and track feeder switchgear, in connection with the Reef railway electrification scheme.
BLOEMHOF.—August 1st. Municipality. Boiler, engine alternator and switchgear. (A.Y. 13110.)*

Southampton.—June 25th. Electricity Department. Electric cookers. (June 14th.)

Southend-on-Sea.—July 4th. Borough Council. Electrical work at the Sutton Road housing estate. A. C. Johnson, engineer and manager, Municipal Buildings, Clarence Road.
July 4th. Electricity Department. Transformers and switchgear. (June 7th.)
July 17th. Adaption from d.c. to a.c. of motors, hairdressing equipment, dental apparatus, petrol pumps and miscellaneous apparatus. (See this issue.)

Swansea.—July 1st. Electricity Department. One 750-kW Diesel engine and alternator. (June 7th.)

Taunton.—June 24th. Electricity Department. Glass bulb rectifier equipments. (June 7th.)

Uruguay.—MONTEVIDEO.—August 5th. State Electricity Supply and Telephones Administration. 38,550 metal filament lamps. (A.Y. 13122.)*

Walsall and Aldridge.—June 29th. Electrically driven pumping plant at the Rushall pumping station. Wilcox, Raikes & Marshall, engineers, 33, Great Charles Street, Birmingham (deposit £2 2s.).

Wembley.—July 9th. U.D.C. Electric lighting installation in forty-eight houses on the High Meadow housing estate, Kingsbury. (See this issue.)

West Lothian.—County Council. Electrical work at forty-four houses at Uphall. F. Smith & Brown, 4, Regent Street, Hamilton.

West Riding.—June 24th. County Council. Electric lighting at Common Road Council school, South Kirkby, and Park Road senior mixed Council school, Wath-upon-Dearne. Education officer, County Hall, Wakefield.

Weymouth and Melcombe Regis.—July 15th. Electricity Department. E.h.p. and l.p. cable, distributor pillars, 2-500-kVA transformers and e.h.p. and l.p. switchgear. (See this issue.)
July 5th. E.h.p. switchgear. (See this issue.)

Witney.—July 8th. Electricity Department. 11,000 V underground cables and overhead lines. (See this issue.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Australia.—COMMONWEALTH.—P.M.G.'s Department. Accepted. Lead sheathed switchboard cable.—Siemens (Aust.) Pty., Ltd. (£927); Ericsson Telephone Manufacturing Co. (£676).

Bedford.—Electricity Committee. Accepted. Supplies for twelve months: Cutouts.—W. T. Henley's Telegraph Works Co., Ltd. Meter boards.—Wootton & Co., Ltd. Cable covers.—H. J. Baldwin & Co. Water heaters.—Johnson & Phillips, Ltd.

Blackpool.—Electricity Committee. Accepted. 1,750-kW motor convertor.—Bruce, Peebles & Co., Ltd.

Bromley.—Town Council. Accepted. Transformers.—Electric Construction Co., Ltd. (£207); British Electric Transformer Co., Ltd. (£89).

Chesterfield.—Electricity Committee. Accepted. Grit arrester at power station (£1,071).—Musgrave & Co., Ltd. Kiosk (£338).—Electric Construction Co., Ltd. Alterations to electrical apparatus (£389).—Supremus Specialities, Ltd.

Dartmouth.—Electricity Committee. Recommended. Cables and joint boxes (£1,164).—Telegraph Construction & Maintenance Co., Ltd.

Doncaster.—Corporation. Accepted. Installation of electricity in 515 houses (£1,743).—Ketley & Taylor. H.p. and l.p. cables (£1,308).—Enfield Cable Works, Ltd.

Dorchester.—Electricity Committee. Recommended. Motors in connection with the change-over (£1,166).—Higgs Motors, Ltd. Meters.—Chamberlain & Hookham, Ltd.; Electrical Apparatus Co., Ltd.

Gainsborough.—U.D.C. Accepted. 250-kVA three-phase transformer for the Town Hall sub-station (£164).—Brush Electrical Engineering Co., Ltd.

Hastings.—Electricity Committee. Recommended. Porcelain insulators (£330).—Bullers, Ltd. Metering equipment (£182).—Metropolitan-Vickers Electrical Co., Ltd.

London.—BATTERSEA.—Electricity Committee. Recommended. Two 350,000-kVA h.p. switches (£2,618).—General Electric Co., Ltd. Oil purifier (£216).—Fraser & Chalmers Engineering Works.
FULHAM.—Electricity Committee. Accepted. For Fulham Cross sub-station: E.h.p. switchgear (£3,180).—English Electric Co., Ltd. H.p. switchgear (£251).—W. Lucy & Co., Ltd. 3,000-V switchgear (£409).—Furguson Pailin, Ltd.
STOKE NEWINGTON.—Electricity Committee. Recommended. Washboilers.—Burnley Components, Ltd. E.h.p., pilot and l.p. cables.—W. T. Henley's Telegraph Works Co., Ltd. Immersion heaters.—Hotpoint Electric Appliance Co., Ltd.

Lowestoft.—Electricity Committee. Recommended. 1,500-kVA transformer (£829).—General Electric Co., Ltd.

Northern Ireland.—BELFAST.—Electricity Committee. Switchgear (£357), reactors (£741) and air ejector and alterations to extraction pumps, etc. (£792).—Metropolitan-Vickers Electrical Co., Ltd. Switchgear (£1,880).—Brookhirst Switchgear, Ltd. Economisers (£11,049).—E. Green & Son, Ltd. Feed water pump (£588).—Mather & Platt, Ltd.

Portsmouth.—Contracts Committee. Accepted. 2,000 switch-fuses.—General Electric Co., Ltd. L.p. disconnecting boxes.—Johnson & Phillips, Ltd.

Swindon.—Electricity Department. Accepted. L.p. p.i. cables for the period ending March 31st, 1936.—Standard Telephones and Cables, Ltd. 200-kVA transformer (£136).—Metropolitan-Vickers Electrical Co., Ltd.

Taunton.—Town Council. Accepted. H.p. switchgear and accessories (£3,500).—Metropolitan-Vickers Electrical Co., Ltd.

Tynemouth.—Electricity Department. Recommended. 625-kVA 5,600-V three-phase transformer (£218).—C. A. Parsons & Co., Ltd.

Uttoxeter.—U.D.C. Accepted. Overhead electric mains to Brookhouse, Stranshall, and Stafford Road (£1,168).—Johnson & Phillips, Ltd.

Wolverhampton.—Electricity Committee. Recommended. Switch unit (£100).—A. Reyrolle & Co., Ltd. Ring main unit (£92).—Crompton Parkinson, Ltd. Switchboard (£478).—Ferguson Pailin, Ltd. 100-kVA transformer (£90).—Electric Construction Co., Ltd.

Forthcoming Events

International Electrotechnical Commission.—Monday, June 24th, to Thursday, June 27th. Brussels, Belgium. Meetings.

Municipal Tramways and Transport Association.—Wednesday, June 26th. Douglas, Isle of Man. Annual conference. The summer meeting continues to Friday, June 28th.

Association of Mining Electrical Engineers (*South Wales Branch*).—Thursday, June 27th. Visit to the works of the Hackbridge Electric Construction Co., Ltd., Hersham, Walton-on Thames.

Paris E.H.T. Conference.—Thursday, June 27th, to Saturday, July 6th.

Notes

The Electric Lodge

The above Lodge celebrates its fiftieth anniversary in the course of a few months. There is to be a special Jubilee meeting in London on Saturday, September 28th. The event will be of interest to many of our readers, for the Electric Lodge has had a large number of electrical men of distinction associated with it. The names of the late Sir William Preece, Sir William Crookes and Mr. Spagnoletti will be recalled amongst those of gentlemen no longer with us. Mr. E. J. Willcock, of 73, Basinghall Street, E.C.2, the secretary, will be pleased to forward particulars to those interested.

E.A.W. Conference at Swansea

The annual conference of the Western Counties and South Wales Federation of the Electrical Association for Women was held at the Guildhall, Swansea, on June 13th, Mrs. John Lake (chairman) presiding.

On behalf of the area council, Mrs. D. W. Newman, of Bristol, moved a resolution urging education authorities to teach the advantages and applications of electricity in the home. Women, she said, should relinquish the rôle of household martyr, and, by employing electricity, have more leisure and healthier surroundings. Miss Caroline Haslett, director of the E.A.W., stated that the demand for lady demonstrators exceeded the supply, and holders of E.A.W. diplomas were always certain of employment. The resolution, seconded by Mrs. Corson (Mid-Gloucester Branch), was carried.

Mrs. J. W. Burr, president of the Swansea branch, presided at the luncheon. Speaking on the future of electricity supply Sir John Brooke, vice-chairman of the Electricity Commissioners, said that our high standard of life was due largely to cheap coal—a factor which, however, became less important in the electricity age on account of the competition from oil and water. It was essential that coal should be utilised in the cheapest possible manner. The grid provided a means, and the Electricity Commissioners had erected 3,000 miles of main transmission line and 26,000 pylons and had spent £29,000,000. If the grid had been in operation in 1930, £42,000,000 of capital would have been saved on reserves. By increasing the uses of electricity and by concentrating on new stations like Tir John, the cost of energy could be reduced. He congratulated the Bristol delegates on the electrification of workmen's homes. A vote of thanks to Sir John was proposed by the Mayor, Alderman W. J. Davies, J.P.

Later the delegates visited Tir John and were guests of the Mayor at tea at the Guildhall. Next year's conference is to be held at Gloucester.

Col. R. G. Crompton receiving a silver salver from Lt.-Col. Hardie (manager of the Chelmsford Works) at last Saturday's sports of Crompton Parkinson, Ltd.

In the House

In the House of Commons on June 17th, in reply to a question by Mr. Paling, Major Tryon (Postmaster-General) said that on the advice of the Television Advisory Committee the use of a site at the Alexandra Palace had been authorised for the projected London Television Station, and the B.B.C. had made arrangements for the use of a portion of the Palace buildings for the station. The Baird Television Company and the Marconi-E.M.I. Television Co. had been invited to tender for the supply of the necessary apparatus for the operation of their respective systems at the station. The Television Advisory Committee had satisfied itself that receivers could be constructed capable of receiving both sets of transmissions without unduly complicated or expensive adjustments, and arrangements would be made for the necessary information to facilitate the designing of receivers to be made available to manufacturers by the respective companies in the event of their tenders being accepted.

The same day Mr. Hales asked the Minister of Transport whether he was aware that the electricity supply in large areas of South-West England was under the control of an American company now in liquidation and accordingly under the control of the American Reconstruction Corporation, a subsidiary of the United States Government; and what steps he proposed to take to ensure that British public utilities were removed from the control of a foreign Government.

Mr. Hore-Belisha said that electricity supply undertakings in this country were operated under statutory control, and changes of the nature referred to would not in any way affect the statutory conditions under which those undertakings operated.

Standard Concrete Poles

The Electricity Commissioners have agreed to allow a lower factor of safety on poles made in accordance with the British standard specification for reinforced concrete poles. This is an important step in the progress of overhead line construction, and should greatly further the popularity of the concrete support. The new specification applies to reinforced concrete poles suitable for use as electrical transmission and traction supports (including supports for telegraph and telephone lines), but does not apply to lamp standards. Seven classes of pole are provided for, giving a wide range of lengths and strengths. The composition of the concrete is dealt with, the types of cement and aggregate being specified, and further paragraphs give information on protection from frost and the recommended method of curing the concrete. The Specification deals with the re-inforcement, the material from which it is made, and the state of the surface. The minimum cover is specified and the Specification states under what circumstances splicing or lapping of the reinforcement is permissible. Several pages are devoted to the testing of standard lengths of poles, and the consistence of concrete. Copies of the Specification (No. 607-1935) may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

"Grid" Proposals in France

In the French Chamber of Deputies recently an inquiry was addressed to the Minister of Public Works as to the progress which was being made with regard to the project to set up a national system of electric power generation and distribution throughout France. In reply, the Minister stated that the project was still being inquired into by the special commission appointed by the Government. This body had judged it necessary, in view of the complexity of the question to divide the inquiry into three sections, each of which was being dealt with by a sub-committee. While everything was being done to hasten forward the work, in view of the extent of the inquiries some time must elapse before the complete reports could be presented.

Appointments Vacant

Visiting teacher for the L.C.C. School of Engineering and Navigation, Poplar.

Mains draughtsman for the Alderley Edge and Wilmslow Electricity Board.

Electrical engineer in the Egyptian Irrigation Service, Sudan.

Grade B male clerk for the Borough of Leyton Electricity Department.

(See our classified advertisements.)

Makers' Names Wanted

EXPRESS vacuum cleaner.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. C. G. Morley New, city electrical engineer, Cardiff, who is leaving to take up his appointment as an Electricity Commissioner, received a presentation from members of the Corporation Electricity Department on June 14th. The presentation was made by Mr. E. Jones, who is succeeding him as city electrical engineer, and Ald. Gough, chairman of Electricity Committee, paid tribute to the work of Mr. Morley New.

[*Lafayette*

Mr. D. Shipton Wood

Mr. D. Shipton Wood, who writes on "Power Station Efficiency" in this issue (page 900) was educated at Bristol Grammar School, Maritzburg (Natal) College and Birmingham Technical School. He completed pupilship courses with the Natal Government and Maritzburg Corporation Electricity Departments, and for six months acted as electrical inspector with the latter authority. Starting with the City of Birmingham Electricity Supply Department in 1910 as junior assistant engineer, he subsequently became assistant chemist and testing engineer, switchman, shift charge engineer, and finally system control engineer in charge of five stations and distribution. He left Birmingham in 1924 and is at present resident engineer at the Ribble generating station of the Preston Electricity Department, being directly responsible to the deputy borough electrical engineer. He is an associate member of the Institutions of Electrical and Mechanical engineers.

Mr. G. Mathewson, of Chester, has been appointed consumers' engineer to the Doncaster Corporation Electricity Department at a salary of £250 a year.

Mr. C. R. J. Parkinson, chairman of the West Midlands Joint Electricity Authority, has been appointed chairman of the conference of Joint Authorities, Joint Advisory Boards and Joint Committee for the current year.

Mr. A. Maude has resigned his position as constructional engineer at the Ashton-under-Lyne Corporation electricity works.

Mr. H. Kaye

Mr. H. Kaye has resigned from the position of secretary and sales manager to Messrs. E. & E. Kaye, Ltd., of Ponders End, Middlesex, to take up the appointment of sales manager for the copper products of the Spencer Wire Co., Ltd., of Wakefield. Mr. Kaye has been with Messrs. E. & E. Kaye since the formation of the business by his father and uncle in 1922.

Mr. S. N. King, who is on the staff of the Watford Corporation Electricity Department, was married on June 3rd to Miss M. T. Rennards, and he has been presented by the staff of the Electricity Department with an all-mains radio set. The presentation was made by Mr. A. W. Barham, the chief electrical engineer and general manager.

Mr. G. B. Wood, of 14, Bath Street, Glasgow, has been appointed Scottish representative to Messrs. Ashley Accessories, Ltd., of Liverpool. Mr. Wood, who is well known in the trade, succeeds **Mr. J. S. McIntosh,** who has represented the company for many years.

Mr. G. K. Fletcher, A.M.I.E.E., of London and Brazil, was married on June 10th at the British Consulate, Rio de Janeiro, to Miss Doris Julia Lazenby, only daughter of Mrs. H. Lazenby, of Withington, near Manchester.

Mr. W. Holmes, of Messrs. Ferranti, Ltd., has been elected chairman of the Meter and Instrument Section of the Institution of Electrical Engineers for the session 1935-36.

Col. R. E. Crompton was presented with a silver salver from 1,400 workpeople and staff of Messrs. Crompton Parkinson, Ltd., to commemorate his ninetieth birthday, at the company's Athletic Club's sports meeting held at Chelmsford on Saturday last.

With the acquittal of **Samuel Insull,** and others, by a Chicago jury of the charge of violating the Federal bankruptcy laws, Mr. Insull has now been cleared of all criminal charges brought against him since his extradition from Turkey. Efforts to extradite Mr. Martin Insull from Canada are reported as abandoned.

Sir Cyril Kirkpatrick has been elected chairman of the committee of the Association of Consulting Engineers for the ensuing year. Sir Cyril is a past president of the Institution of Civil Engineers.

In our last issue we announced the appointment of **Mr. W. H. Wilson** as manager and secretary of the London Electric Supply Corporation, Ltd., and we now have pleasure in reproducing his portrait. **Mr. J. G. Freeman,** M.I.E.E., whose retirement from the position of manager and chief engineer to the company (on March 31st) was also referred to, had been on the engineering staff of the undertaking for forty-five years. His previous experience had been with the United Telephone Co., which he joined in 1888, shortly before its absorption by the National Telephone Co. During his two years there he was engaged in the installation of the old Mincing Lane exchange, which used the original Edison plug switchboard with "cribbage pegs" connected to an overhead single-conductor system with iron wires, and the Smithfield exchange, which included an early Western-Electric multiple switchboard. He then spent some time in the Cannon Street workshops and instrument test room in the N.T. Co. Mr. Freeman's earliest work with the L.E.S. Co. was in connection with the laying of the original Ferranti 10,000-V cables and also the still-serviceable Siemens jute-insulated 2,500-V concentric cables. In 1893 he relaid in the streets the Ferranti mains on the South-Eastern Railway viaduct. He became superintendent engineer of distribution in 1911 and manager and chief engineer in 1930 on the retirement of Mr. G. W. Partridge. During his term of control he was responsible for changing over to standard frequency the Ferranti 10,000-V, 85-cycle, single-phase system and the 6,600-V, 25-cycle, three-phase system.

Mr. W. H. Wilson

Obituary

Mr. G. E. Swift.—The death occurred recently of Mr. George Ernest Swift, deputy electrical engineer and manager of the Chester electricity undertaking, at the age of 59. Before going to Chester he was mains engineer to the Plymouth Corporation. A former chairman of the North Wales Branch of the E.P.E.A., he also served on the committee of the Mersey and North Wales Section of the I.E.E.

Mr. Charles Ernest Tissington, of Brimington, Chesterfield, died in the Sheffield Royal Infirmary last week, at the age of sixty-six. He was a director of the Brimington Electric Supply Co., and was elected to the board following a period as the engineer. For many years he was the works electrical engineer to the Staveley Coal & Iron Co.

Mr. J. Bell.—The death occurred suddenly at his residence in Paisley on June 10th, in his fifty-eight year, of Mr. Joseph Bell, a well-known electrical contractor. He carried out many important contracts, including the electrical work at the James Watt College. Mr. Bell is survived by his wife, three sons and a daughter. The sons are all engaged in the business.

Mr. W. Hamer.—The death has occurred, after a brief illness, of Mr. William Hamer, head of Messrs. Hamer & Co., Ltd., electrical engineers, Halifax, at the age of 68.

Wills

Mr. John Gray, a director of the British Thomson-Houston Co., Ltd., and chairman of the Hotpoint Electric Appliance Co., Ltd., left personal estate in Great Britain valued at £19,028.

Mr. J. H. Holmes, founder of Messrs. J. H. Holmes & Co., Ltd., left £1,662, with net personalty £1,595.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Audion, Ltd.—Private company. Registered June 5th. Capital, £1,000 in £1 shares (500 ordinary and 500 8 per cent. non-cumulative preference). Objects: To carry on the business of manufacturers and makers of deaf aid instruments, sound instruments, wireless, talking machines, &c. The first directors are: W. A. Cullen, Creag Innich, 28, Comrie Street, Tollcross, Glasgow, E.2; and Wm. A. Saxby, "Sandy Knoll," Adlington, Cheshire. Solicitor: T. Hume Oliver, 26, Cross Street, Manchester.

West London Electric (Acton), Ltd.—Private company. Registered June 11th. Capital, £2,000 in £1 shares. Objects: to carry on the business of manufacturers, distributors and wholesalers of and agents for the supply of all kinds of electrical goods and equipment, radio instruments, &c. The first directors are: C. J. Ryan, 30, Derwentwater Road, Acton, W.3; and G. A. Ryan, 23, Lynton Road, Acton, W.3. Registered office: 9/11, High Street, Acton, W.3.

Lukely Engineering & Moulding Co., Ltd.—Private company. Registered June 7th. Capital, £3,000 in £1 shares. Objects: To acquire the business (1) of an electrical and general engineer. &c., heretofore carried on by A. Allison at the Lukely Engineering Works, 180, Carisbrooke Road, Newport, I.W., as The Lukely Engineering Co.; (2) of a plastic moulder, &c., also carried on by A. Allison at the same address as The Newport Moulding Co. The subscribers are: A. Allison, "Hunter's Way," New Road, Wootton, I.W.; and J. Chance, 40, Monkton Street, Ryde, I.W. The first director is Alexander Allison (managing director). Solicitors: James Eldridge & Sons, 17, Lind Street, Ryde, I.W.

Clifford Vowles, Ltd.—Private company. Registered June 12th. Capital, £2,500 in £1 shares. Objects: To acquire the business of an electrical engineer and contractor carried on by Clifford Vowles at Halifax. The first directors are C. Vowles, and Mrs. Bertha Vowles, both of 6, Park Place, Halifax. Registered offices: 9, George Square, Halifax.

Hart Neon Manufacturers, Ltd.—Private company. Registered June 7th. Capital, £1,500 in 10s. shares. Objects: To acquire the business of a neon specialist and manufacturer and supplier of luminous tubes and signs carried on by B. J. Smallwood as G. I. Hart Neon Specialists and Manufacturers at Broughton Cottage Works, Alma Grove, N.1, and at 80, Copenhagen Street, N.1. The permanent directors are: B. C. Smallwood, 21, The Grove, Blackheath, S.E.; and K. Grimm, 18, Rochester Square, N.W.1. Registered office: Broughton Works, Alma Grove, N.1.

Empiric, Ltd.—Private company. Registered June 14th. Capital, £500 in 2s. shares. Object: To carry on the business of manufacturers and repairers of and wholesale and retail dealers in electrical and mechanical and musical apparatus and accessories, wireless sets, gramophones, etc. The directors are: H. J. Wells (chairman), 17, Oakhurst Rise, Carshalton Beeches, and three others. Registered office: 22, Walbrook, E.C.4.

Returns of Electrical Companies

Ultra Electric, Ltd.—Satisfaction in full on June 3rd, 1935, of debenture dated January 23rd, 1935, and registered January 29th, 1935. (According to the register of mortgages the debenture registered January 29th, 1935, originally secured all moneys due to bank.)

Wellington District Electricity Co., Ltd.—The nominal capital has been increased by the addition of £15,000 in £1 ordinary shares beyond the registered capital of £45,000.

Southern Areas Electric Corporation, Ltd.—The nominal capital has been increased by the addition of £500,000 in £1 ordinary shares beyond the registered capital of £350,000.

Bakelite, Ltd.—The nominal capital has been increased by the addition of £100,000 in £1 ordinary shares beyond the registered capital of £200,000.

Macfarlane Electrical Co., Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1934 (filed March 27th, 1935). All shares taken up. £3,000 paid. Mortgages and charges, nil.

Mackett & Kelk, Ltd.—T. S. Macadam, Dome Buildings, Richmond, Surrey, ceased to act as receiver on May 31st, 1935.

Retail Sales, Ltd.—Particulars filed of £1,000 debentures authorised June 5th, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £300.

Convertors, Ltd.—Debenture dated May 10th, 1935, to secure £50, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. Amy F. Macleod, "Penffordd," Groes Road, Colwyn Bay.

Cliffdown Appliances, Ltd.—Issues on January 30th of £400 and on March 16th, 1935, of £100 debentures, part of a series already registered.

Higgins & Griffiths, Ltd.—Satisfaction in full on various dates from July 1st, 1934, to April 1st, 1935, of debentures authorised October 31st, 1932, and registered November 2nd, 1932, securing £30,000.

New Era Time & Telephone Systems, Ltd.—Capital, £1,000 in 1s. shares. Return dated January 14th, 1935. 18,797 shares taken up. £939 17s. paid. Mortgages and charges at date of return, £16,668 7s. 3d.

Leslie Fink, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1934 (filed May 14th, 1935). All shares taken up. £2 paid. £998 considered as paid. Indebtedness in respect of mortgages and charges at date of return, £2,653.

City Notes

The General Electric Co., Ltd., reports a profit for the year ended March 31st last, of £1,184,483, an increase of £213,000 as compared with the preceding year, to which is added £423,438 brought in making £1,607,921. From this is deducted debenture interest (£103,930), depreciation (£259,293), directors' remuneration (£4,525), and contributions to pension fund (£40,601). The dividend on the "A" preference shares absorbs £90,675, and on the "B" preference shares £104,625, and after placing £142,576 to taxation reserve and £98,883 to general reserve, there is a balance available of £762,813. It is proposed to pay an ordinary dividend for the year of 10 per cent. (against 8 per cent.), leaving a balance of £467,018 to be carried forward. The report states that after four years of depression the directors are pleased to report a new record of trading profits. All the company's works have been fully employed throughout the year. The heavy engineering works have benefited by the increased demand for industrial and mining plant, whilst the greater purchasing power of the public has favourably affected the business in general electrical supplies. In certain departments the demand has exceeded productive capacity, and necessitated considerable extensions to the manufacturing organisation. Extensions are also in progress at the Kingsway premises and in some of the Home branches the volume of the company's export business shows a considerable increase on last year's figure. Whilst this result is to some extent due to the activity in the gold mining industry, an increased demand for electrical commodities has been evident in nearly all the markets. Of the overseas branches, South Africa, India and Australia have reported satisfactory trading results, whilst Singapore and China have made considerable improvement. In the Argentine and France local conditions have adversely affected results. During the year redemption was effected of the outstanding £3,482,500 debenture stock by an issue of ordinary shares at premium. This operation, after deducting all issue expenses, has added £1,701,117 to the reserve account, which now stands at £3,400,000. The increase in "debtors" and "stock" reflects the growth of the company's business and accounts for a decrease of about £258,000 in liquid resources which at the end of the year amounted to £2,068,000. The number of employés has attained the record figure of 29,968, an increase of 5,733 over the previous year. The assets of the contributory pension fund now amount to £1,200,000, and the membership of the fund it 6,100. Meeting: June 27th.

Accompanying the report shareholders have received a 28-page booklet of illustrations of typical manufactures of the company with appropriate letterpress. Shareholders are invited to become business-getters for the company in which they are interested.

Telephone Rentals, Ltd., held its annual meeting on June 17th., when Mr. F. F. Jackson (chairman and managing director), who presided, said that the "new system" subsidiary companies had had a very favourable year and that business continued to progress on the high level already attained. During the year the rental revenue had increased by 12 per cent. as compared with 10 per cent. last year. The renewal of old installations carried out during 1932 and 1933, coupled with the reorganisation of the maintenance service had had very satisfactory results, for the cost of maintenance in ratio to rental had fallen by a considerable amount as a direct consequence. The intensive sales development campaign was being continued, and in consideration of the generally improved trade this should produce better results during the current year. The newest types of apparatus now installed had met with general appreciation; these include a complete range of loud-speaking telephones, code signalling devices and automatic switchboards. Electro-Rentals, Ltd. again made a small loss in the year under review. This company had only traded in the London area, on a comparatively small scale, and now that sufficient experience had been gained in this new line of development in the rental business a scheme for extensions into some provincial centres was under consideration. In Australia an interest had been acquired in a factory for producing refrigerators, radio sets and electricity meters. Good business was being done and a small dividend had been distributed. During the year they had negotiated an agreement with the Kelvinator Corporation of America to manufacture refrigerators under their patents, while on the wireless side they had successfully negotiated an agreement with the Philco Corporation of Philadelphia to manufacture receiving sets under their patents. It was proposed to issue half of the increased capital authorised, namely 400,000 shares of 5s. each, at a premium of 2s. 6d. per share which would be offered to shareholders in the ratio of one new share for every six held. The increase in capital was necessary in order to finance the development of the "new system" subsidiary companies' business, while additional finance was also needed in Australia. The position was that although the operating companies had earned substantial profits they were short of working capital for manufacturing and distribution. The issue would yield £50,000 in share premiums of which £25,000 would be appropriated for financing intensive sales development through the medium of the "new system" subsidiary companies and £25,000 would be added to general reserve account.

The Electrical Finance & Securities Co., Ltd., held its annual meeting on June 13th, when Mr. G. H. Nisbett (chairman), who presided, said that the company had an overdraft at the bank at the end of the year of £41,175. This figure was steadily growing, owing to the constant expansion of the business of their subsidiary companies. There was consequently a continual need for additional capital. This need was becoming increasingly urgent, but they had thought it wise to postpone the issue of further capital until the results of the present negotiations with the Hendon and other Councils became

definite, because in the event of the Pinner and Rickmansworth undertakings being sold the company would receive a sum of money in satisfaction which would serve its needs for a very considerable period. In addition to the notice received for the purchase of the Pinner undertakings, the company had received notices from the Rickmansworth and Chorley Wood Urban District Councils of their intentions to purchase such parts of the undertaking of the Colne Valley Co. as were within their respective areas as on July 31st, 1935. The directors were of opinion that the best interests of the shareholders would be served if these districts could be retained for a further term of years. Negotiations to that effect were accordingly proceeding and they had hope of a satisfactory conclusion.

W. T. Henley's Telegraph Works Co., Ltd., report that the balance on trading account for the year ended March 31st last is £279,448 (against £278,586 in 1933-34), from which is deducted directors' and auditors' fees, debenture interest, and depreciation, leaving a net profit of £208,979 (£209,874). To this is added £473,453 brought in, making a total of £682,431. A final ordinary dividend of 2s. 6d. per share (less tax) is recommended, making 4s. for the year, and this, with a cash bonus of 2s. per share (less tax), makes the total distribution for the year of 30 per cent. (same). It is also proposed to transfer £18,564 to reserve against trustee securities, leaving a balance of £459,867 to be carried forward. The report states that notice was given to holders of the £150,000 4½ per cent. debenture stock to redeem that stock on June 1st, 1935, at 105 per cent., and the transaction has now been completed. The total amount necessary for the redemption of the stock was provided from the company's own resources. Henley's (South Africa) Telegraph Works Co., Ltd., has made a satisfactory profit, but Henley's Tyre & Rubber Co., Ltd., made a loss, which has been met out of its own reserves. This company has a substantial balance to the credit of the profit and loss account in respect of undistributed profits of previous years. Another subsidiary, the Holborn Construction Co., Ltd., was formed during the year, and although it has only been in operation a few months the outlook is promising. Meeting: June 28th.

The Electric Furnace Co., Ltd., reports a net profit for the year ended March 31st last of £14,339, which with £1,793 brought in makes £16,132. General reserve receives £2,500 and the final ordinary dividend is 4½ per cent., making 7 per cent. for the year, leaving £2,205 to be carried forward. During the financial year the company's business at home has continued at a satisfactory level. Its connections and goodwill in foreign markets have been maintained, in spite of international difficulties, and valuable orders have been received from abroad. Important new metallurgical developments have been investigated abroad, and the British licence for a new type of electric furnace of French origin has been obtained. The subsidiary, Electric Resistance Furnace Co., Ltd., has carried out a great deal of development work, the value of which is proved to have been fully justified by the large increase of orders received during the period since the end of the financial year. The difficult problem of the bright annealing of copper by a dry process has been satisfactorily solved, and important orders for equipment received. During the two months since the close of the financial year large orders have been received by both the company and its subsidiary, the value of the first two months' orders being equal to 55 per cent. and 58 per cent. respectively of the amounts for the whole of last year.

The Young Accumulator Co. (1929), Ltd., held its annual meeting on June 12th, when Lt.-Col. L. P. Winby (chairman), who presided, said that the company had continued its improvement, and although they had not had the benefit of the new extensions, into which they had recently moved, they had made a net profit of £6,156 for the year. The patents item quoted in the balance sheet at £1 covered the process of manufacture of "Porbonite" and the armoured positive plate which had resulted in the introduction of the super-armoured battery now used for car starter and lighting batteries as well as for heavier commercial vehicle batteries. This battery had brought them prominently into the electric traction field, and in the case of large vehicles ran into substantial sums which would provide a marked addition to the turnover. Sales for marine work and the demand for aviation purposes also showed great improvement. The reorganisation of the older portion of the works had been practically completed, and it was hoped that this, together with the new extensions, would mean substantial economies in working and increased output. The improvement noted last year had been successfully maintained, and they looked forward to further progress and expansion.

The Madras Electric Supply Corporation, Ltd.—Presiding at the annual meeting on June 12th, Mr. J. Gray (chairman) said that the kWh generated, compared with 1933, showed an increase of 4.9 per cent. and sales by 4.7 per cent., but the traffic receipts from the tramways and the number of passengers carried showed reductions of 0.5 and 1.5 per cent. respectively. In July, 1933, a reduction in the lighting and fan tariff had been made, and although the response to this had been very poor there was now under consideration a two-part tariff which, it was hoped, would be satisfactory to consumers and suppliers alike. To consolidate the improvements of recent years, schemes had been put in hand for the storage, purification and cooling of water, while on the distribution side two substations were being enlarged and two additional stations were to be erected, equipped for mercury-arc rectifiers and ready for operation by the latter part of the current year. An extension of their area to Tambaram had been authorised by the Government, and a high-pressure distribution scheme had to be designed.

Electric Construction Co., Ltd.—Presiding at the annual meeting on June 18th Mr. J. Gray (chairman and managing director) said that the company had emerged from an unprecedented period of depression with its financial position unimpaired. The accounts showed an improvement on that of a year ago, and every department of the works was fully employed. During the year under review the number of machines produced increased over the preceding year by 60 per cent., and their capacity in kW by 78 per cent. This substantially increased manufacturing profits, although during the first half of the year little benefit was obtained from higher selling prices. Later, however, prices improved, but competition was still strenuous. Referring to the outlook, the chairman said that work in progress at the beginning of the current year was treble in value of that of a year ago. This was chiefly due to home trade, but it was gratifying to realise that Dominion and export markets had generally improved. If the demand continued on the present scale the accounts submitted a year hence would show satisfactory progress.

The British Electric Traction Co., Ltd., held its annual meeting on June 14th, when Mr. J. S. Austen (chairman), who presided, said that their profits for the past year had been the highest in the history of the company, being £37,000 better than those of the previous year. They had made a valuation of their investments which they found was, apart from other assets, £12,973,000, the total of the debenture and share capital being £4,150,000. If they could pay off the whole of their debentures and preference stock at par there would be sufficient left to give £1,750 for each £100 of deferred stock, with a nice balance over. A large proportion of their income was derived from omnibuses and tramways, though the latter was to-day a small and diminishing consideration. They also participated actively in the management of a large number of companies, and they managed or participated in the management of fifty-four omnibus and tramway companies which collected £15,800,000 in fares last year.

Ward & Goldstone, Ltd., report for the year ended March 31st, 1935, a net profit of £35,334 (against £28,461). From this is deducted directors' fees, income tax and depreciation, leaving £22,654, to which is added £28,179 brought in giving a balance available of £50,833. It is proposed to pay an ordinary dividend of 10 per cent., less tax, as compared with 7 per cent. for the previous year and to capitalise and issue £6,445 15s. as fully paid ordinary shares of 5s. each, ranking *pari passu* in all respects with the existing issued ordinary shares, and that such shares be distributed amongst ordinary shareholders, in the proportion of one new ordinary share for every ten shares held. It is also proposed to transfer £2,000 to income tax reserve and £10,000 to general reserve, leaving £23,048 to be carried forward. The report states that output and turnover have been well maintained in the face of severe competition.

The Lisbon Electric Tramways, Ltd., reports a net profit for 1934 of £173,032, after deducting interest on and redemption of debentures and interest charges in connection with the Companhia Carris de Ferro de Lisboa (against £177,620), to which is added £46,063 brought in, making a balance available of £219,095. A final dividend of 4½ per cent. is recommended on the ordinary shares, making 7½ per cent. for the year (same) and £52,234 is to be carried forward. During the year under review the passengers carried totalled 120,534,321, showing an increase of 1,723,812 over the previous year's figures.

The James Keith & Blackman Co., Ltd., reports a net profit for the year ended March 31st last of £23,916, as compared with £15,070 in the preceding year, to which is added £10,263 brought in. The ordinary dividend for the year is 12½ per cent., less tax (against 9 per cent.), and £10,550 is carried forward.

Hick, Hargreaves & Co., Ltd., report a profit for the year ended March 31st last of £9,892, and after providing for depreciation, debenture interest, &c., a net profit of £4,358 (against a net loss of £6,796 for 1933-34), which, with £153 brought in, makes £4,511 available. A dividend of 1¼ per cent. (less tax) is recommended (against ¼ per cent.) and £1,000 is placed to general reserve, leaving £511 to be carried forward.

Vactric, Ltd., has declared an interim ordinary dividend of 5 per cent. (actual), less tax. The company states that during the half-year to March 31st last the turnover continued to expand. Net profits, however, were adversely affected by alterations and extensions which were necessary at the factory to cope with the increase in business and by the expenses attendant upon introduction of new models.

The Victoria Falls & Transvaal Power Co., Ltd., has declared a final ordinary dividend of 11 per cent., making 15 per cent. for the year (unchanged), and a bonus of 5 per cent. (same) payable out of the balance of exchange credited to No. 2 reserve fund at December 31st, 1932.

The Notting Hill Electric Lighting Co., Ltd., has announced an interim ordinary dividend of 4 per cent., less tax (unchanged).

The London Electric Wire Co. & Smiths, Ltd., is maintaining an interim ordinary dividend of 1¼ per cent.

Stocks and Shares

TUESDAY EVENING.

THE leading feature of the Stock Exchange markets is, once more, the demand that prevails for shares in the industrial companies likely to benefit from orders arising out of the £35,000,000 grant which the Government is going to make towards electrification of certain suburban lines, and the necessary work in connection therewith. Reference to the list of share-prices will show a number of gains in the principal shares. These advances are very far from being due to nominal considerations. They have come about as the direct result of lively dealings in the shares of all the companies likely to be affected by the scheme, which, by the way, was due for presentation after the opening of Parliament on Tuesday in this week. The next most active market has been that for Cable & Wireless stocks. There is a good deal going on in most parts of the House. The cheerful tendency discernible in many of the markets holds some warranty by reason of the

satisfactory reports now being issued by many of the leading undertakings.

Gilt-edged stocks are steady, without any special feature. London Passenger Transport "C" remains at 100. Central Electricity and others of the same group show no variation on the week. An early issue of stock by the London Passenger Transport Board would surprise nobody. The Southern Railway announces its intention to electrify its line to Portsmouth.

Electricity Supply Shares

Notting Hill Electric 5 per cent. preference shares have moved up to 14¾. Something of a run occurred on North Metropolitan ordinary shares. The price spurted 3s. to 64s. 3d., for no reason which transpired. Llanellys hardened to 23s. 9d. Scottish Power ordinary at 42s. 6d. are 9d. better. In the Foreign & Colonial list, very few changes have taken place. Palestine "A" strengthened to 39s. 9d. A rise of a few pence carried British Light & Power ordinary to 27s. 6d. Tokyo Sixes at 86 were quoted on Monday in this week ex the 3 per cent. half-yearly coupon, allowing for which, the price is rather weaker on balance. Victoria Falls ordinary, at 7⅛, are down 3s. 9d. Electrical Finance & Securities are firmer at 66s. 9d., the Chairman's speech at the recent meeting bringing in buyers of the shares. London Assoc. Units moved up to 34s.

British Electric Traction

An outstanding feature of the week was a rise of 180 points in the deferred ordinary stock of the British Electric Traction Company. Three months ago the price was about 900; to-day it is 1,050 ex bonus, after being nearly 1,200 cum bonus.

Fluctuations in Crompton Parkinsons

From the dramatic point of view, the leading cause of excitement in the market for equipment shares has been the jump in Crompton Parkinsons. Mention was made here last week of the way in which Cromptons were changing hands in parcels of several thousands at a time. The price then was 56s. 3d. Since it has been up to 67s., down again to 61s., and, at the moment, on Tuesday evening, is 65s. Various rumours have been in circulation to account for these gyrations, the one most popular being that a bid was being made, or had already been made, for the company's shares. The buying of the latter was of the kind which Stock Exchange opinion calls "good"; that is to say, it emanated from people who, as a rule, prefer to pay for what they buy rather than to carry over. At any rate, lively interest has been aroused, and definite developments are awaited with keen attention. At the present price and the current rate of dividend the yield on the money works out to one per cent.

Manufacturing and Equipment

Brush ordinary stock, after a rise to 52, went back 9½ points upon publication of the report and balance sheet to December 31st last. General Electrics reacted upon the declaration of a final dividend, making 10 per cent. for the year, being 2 per cent. more than that declared for the previous period. A larger amount of ordinary share capital ranks for dividend payment this time. Optimism had looked for a bonus to be declared in addition to the dividend; and sales of the shares by disappointed bulls resulted in a decline of 2s., to 57s. 6d. Henleys are a good spot at 7½. Callenders retain their previous week's rise of 6s. 3d. The market as a whole is very firm. Aron Electricity at 63s. 9d., showing a loss of 2s. 6d., are an exception to the general strength.

Cable and Wireless

Proprietors of Cable & Wireless preference are reminded that June 25th is the last day for tendering stock for sale at 100 to the company. The market value is now all but 100. Buying of the "A" ordinary stock, which lifted the price 1¾ to 26¾ (some people paid up to 28), is thought to be advance reinvestment of their money by preference stock holders, who expect to get 100 for a third of their preference stock. Speculative investment is naturally taking a hand. The "B" stock has risen 30s., to 8½. Marconi marines are 7/6 better at 35s. International Telegraph & Telephone at 9½ is a dollar to the good. Gt. Northerns are a dull market.

Telephone Shares

The price of Telephone Rentals is steady at 9s. 3d. Telegraph Constructions hold their rise at 25s. Ericsson's Telephones have been again a very firm spot at 6 19/16. London Electric Wire ordinary and preference are firm at 27s. and 32s. respectively. International Automatic Telephone ordinary, after a rise to 43s., reacted to 42s. Chloride Electric Storage "A" shares are better at 73s. 6d. The "B" shares are more easily purchasable, the price being about 9d. lower. Broadcast Relay Services strengthened to 6s. 9d. Electric Constructions have risen to 20s. English Electric preference, at the same price, are 1/6 lower on fairly heavy profit-taking.

Miscellaneous Matters

Babcock & Wilcox put on 3s., the price advancing to 48s. 6d. Iron, coal and steel shares are attracting a large amount of attention; the daily turnover of shares in this market is unusually great. Rubber shares are better on account of an advance in the price of raw rubber.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price. June 18.	Rise or Fall.	Yield. p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	76/3	—	3 18 9
Brompton Ordinary	1	7	7	33/6	—	4 3 7
Charing Cross Ordinary	1	7	7	33/9	—	4 3 0
Chelsea	1	7	7	33/6	—	4 3 7
City of London	1	7½	7½	36/–	—	4 3 4
Clyde Valley	1	7	8	43/–	—	3 14 5
County of London...	1	10½	10½	57/–	—	3 13 8
Edmundson's 7% Pref.	1	7	7	36/–	—	3 16 9
Elec. Dis. Yorkshire	1	9	9	48/–	—	3 15 0
Elec. Supply Corporation ...	1	11	11	3 1/16	—	3 11 10
Kensington Ordinary	1	7	7	33/6	—	4 3 7
Lancs Light and Power	1	7½	7½	39/–	—	3 17 0
London Electric	1	7	8	37/6	—	3 14 8
Metropolitan	1	10	10	53/–	—	3 15 6
Midland Counties	1	7	7	37/6	+6d.	3 14 8
Mid. Elec. Power	1	8	8	40/–	—	4 0 0
North Eastern Electric Ordinary	1	6	6	34/6	+6d.	3 9 8
Do. 7% Pref.	1	7	7	36/–	—	3 17 9
Northampton	1	10	10	53/9	—	3 14 1
Notting Hill 6% Pref.	10	6	6	14¾	+¼	4 1 4
North Met. Elec. Ordinary ...	1	10	10	64/3	+3/–	3 2 6
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
St. James and Pall Mall	1	7	8½	33/6	—	4 18 6
Scottish Power	1	8	8	42/6	+9d.	3 15 4
South London	1	7	7	35/–	—	4 0 0
Westminster Ordinary	1	7	7	33/6	—	4 3 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	44/–	—	3 12 9
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	116	—	4 6 2
Do. 1955–75 ...	,,	5	5	118	—	4 4 9
Do. 1951–73 ...	,,	4½	4½	110	—	4 1 10
Do. 1963–03 ...	,,	—	3½	101	—	3 10 0
London & Home Counties, 1955–75	,,	4½	4½	114	—	3 19 9
London Passenger Transport, A...	,,	—	4½	124½	—	3 12 3
Do. do. B...	,,	—	5	127½	—	3 18 9
Do. do. C...	,,	3	—	100	—	3 0 0
West Midlands Joint Elec. 1948–68	,,	—	5	115	—	4 7 0
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	128½xd	—	7 0 0
Anglo-Am. Tel. Pref.	Stock	6	6	116½	—	5 3 0
Do. Def.	,,	1½	1½	27½	—	5 9 1
Cable & Wireless 5½% Pref. ...	,,	2¾	4½	99	+1	4 3 4
Do. A. 7½% Ord.	,,	Nil	Nil	26½	+2½	—
Do. B. Ord.	,,	Nil	Nil	8½	+½	—
Globe Tel. & Tel. Ord.	10	2½	3½	14½	—	2 8 3
Do. do. Pref.	10	6	6	14½	—	4 2 9
Great Northern Tel.	10	20	20	39	–1½	5 5 3
Marconi-Marine	1	10	7½	35	+7/16	4 5 9
Oriental Telephone Ord.	1	12	12	3 1/16	—	*3 12 5
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	2/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1050	+55	—
Do. do. Pref. Ord.	,,	8	8	173½	—	4 12 2
Brazil Traction	100	—	—	9¾	—	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	96½	+4	5 3 8
Mexican Light Common	100	Nil	Nil	3	—	—
Do. 7% Pref.	100	7	7	5½	—	—
Do. 1st Bonds	$500	5	5	42½	—	—
Victoria Falls Ord.	1	15	20	7⅛	–1/16	2 16 2
Yorkshire (West Riding) ...	1	5	6½	33/9	+1/16	3 17 0
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	63/9	–½	4 14 0
Assoc. Elec. Ord.	1	4	6	32/9	–6d.	3 13 3
Do. Prf.	1	8	8	37/6	—	4 5 4
Babcock & Wilcox	1	6	8	48/6	+3/–	3 6 0
British Aluminium Ord.	1	5	7½	38/–	+1/16	3 19 0
British Insulated Ord.	1	5	15	4½	—	3 9 9
Brush Ord.	Stock	Nil	Nil	42½	–7½	—
Callender's...	1	15	15	3 3/16	—	3 18 4
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord. ...	5/–	—	12½	3½	+1/16	1 0 0
Do. 8% Pref.	1	8	8	36/3	—	4 8 5
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	1	+1/–	3 10 0
Enfield Cable Ord.	1	25	25	5½	—	4 17 7
English Electric	1	Nil	Nil	16/3	—	—
Do. do. Pref.	1	Nil	Nil	1	–1/16	—
Ever Ready	5/–	35	35	22/6	—	7 15 6
Ferranti Pref.	1	7	7	28/6	+6d.	4 18 3
G.E.C. Pref.	1	6½	6½	35/–	—	3 14 4
Do. Ord.	1	8	10	57/6	–2/–	3 9 7
Henley's	1	30	30	7½	+1/16	4 4 2
Do. 4½% Pref.	5	4½	4½	5½	—	3 16 8
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	40/–	—	3 15 0
Siemens Ord.	1	6½	4	1½	—	3 4 0
Telegraph Construction	£1	Nil	Nil	1½	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

22720. "Television and the transmission of sound pictures with sounds appropriate thereto." Electric & Musical Industries, Ltd., C. O. Browne and J. Hardwick. August 14th, 1933. (428852.)

26133. "Impulsing arrangements particularly applicable to automatic telephone systems." Telefonaktiebolaget L. M. Ericsson. October 4th, 1932. (428856.)

27927. "Radio-frequency variable inductances." N. H. Freeman. November 12th, 1934. (428092.)

28976. "Electric power converting apparatus." British Thomson-Houston Co., Ltd. October 26th, 1932. (429018.)

29091. "Electrical measuring instruments." A. Davy and Weston Electrical Instrument Co., Ltd. October 20th, 1933. (429019.)

29092. "Electrical testing instruments." Weston Electrical Instrument Co., Ltd. (Weston Electrical Instrument Corporation). October 20th, 1933. (429020.)

29283. "Sound-transmission, sound-recording and sound-reproducing systems." A. D. Blumlein and Electric & Musical Industries, Ltd. October 23rd, 1933. (Addition to 394325.) (429022.)

29405. "Means for regulating the speed of polyphase alternating-current motors." H. V. James. October 24th, 1933. (429094.)

30959. "Exchange system for audio-frequency subscriber telegraphy." Siemens & Halske Akt.-Ges. November 8th, 1932. (Cognate applications 30960/33 and 30961/33.) (429095.)

31436. "Electric switches of the snap-action type." J. A. Crabtree. November 11th, 1933. (428861.)

31609. "Arrangement for driving vehicles by electric transmission from an internal-combustion engine." Allmanna Svenska Electriska Aktiebolaget. February 21st, 1933. (Addition to 418409.) (428862.)

31860. "Electric motors." British Thomson-Houston Co., Ltd., and A. H. Maggs. November 15th, 1933. (428865.)

32130. "Joints for electrical conductors." Edison Swan Cables, Ltd., and F. Gale. November 17th, 1933. (428870.)

32328. "Electric-discharge lamps." General Electric Co., Ltd. November 19th, 1932. (429030.)

32421. "Electrical circuit-control devices." Weston Electrical Instrument Corporation. September 8th, 1933. (429177.)

32429. "Electric switches of the snap-action type." J. A. Crabtree. November 21st, 1933 (Cognate application 19356/34.) (429178.)

32445. "Electric batteries." H. D. Henry. November 21st, 1933. (429179.)

32491. "Electric motor control systems." General Electric Co., Ltd., and E. P. Collett. November 21st, 1933. (429181.)

32550. "Electric switches specially applicable to thermostats." T. A. Ledward. November 22nd, 1933. (428874.)

32599. "Magneto-electric apparatus." J. Lucas, Ltd., and E. A. Watson. November 22nd, 1933. (428939.)

32750. "Bushing insulators for electrical conductors." Steatite & Porcelain Products, Ltd. (Hermsdorf Schomburg Isolatoren Ges.). November 23rd, 1933. (429182.)

32754. "Electric lamps of tubular form." H. Mayer. November 23rd, 1933. (429033.)

32946. "Apparatus for automatically controlling the voltage and current relations in an electric circuit." T. A. Behrens, G. S. Miller and Westinghouse Brake & Signal Co., Ltd. November 24th, 1933. (429103.)

32948. "Electric motors." British Thomson-Houston Co., Ltd., and W. R. Holland. November 24th, 1933. (429109.)

32958. "Electric welding apparatus." E. W. Holland, T. W. Caesar, G. A. Hasselden and Tools & Machinery Supplies, Ltd. November 24th, 1933. (429183.)

33349. "Control of electric motors in traction systems." H. K. Ramsden and Associated Electrical Industries, Ltd. November 28th, 1933. (Cognate application 36142/33.) (429194.)

33835. "Single-phase alternating-current electric motors." British Thomson-Houston Co., Ltd., and A. H. Maggs. December 1st, 1933. (428876.)

33883. "Electric switches of the tumbler type." J. A. Crabtree. December 2nd, 1933. (428877.)

34193. "Signs for advertising or signalling purposes." M. Compare. April 4th, 1933. (429042.)

34402. "Electrical contact-making mechanisms." Ericsson Telephones, Ltd., and E. Robinson. December 7th, 1933. (429197.)

35415. "Means of starting synchronous electric motors." English Electric Co., Ltd., and J. B. Young. December 16th, 1933. (429200.)

35490. "Electromagnetic therapeutic apparatus." S. S. S. Simpson. December 16th, 1933. (429044.)

35738. "Cathode-ray tubes." General Electric Co., Ltd., B. P. Dudding and L. C. Jesty. December 19th, 1933. (429045.)

36540. "Domestic electric bathing appliance." J. R. C. Millis. December 29th, 1933. (428953.)

1934

2932/3. "Electric motors." British Thomson-Houston Co., Ltd. January 27th, 1933. (428957/8.)

4501. "Sound-transmission, sound-recording and sound-reproducing systems." A. D. Blumlein and Electric & Musical Industries. February 10th, 1934. (Addition to 394325.) (429054.)

6011. "Electric radiators and fires." W. M. Betts. February 23rd, 1934. (429057.)

6144. "Electric heating devices for buildings." Revo Electric Co., Ltd., and F. H. Reeves. February 26th, 1934. (429212.)

6935. "Self-starting synchronous motors." R. C. Graseby. March 5th, 1934. (428885.)

8395. "Protective devices for electric traction systems." R. Brooks and Associated Electrical Industries, Ltd. March 16th, 1934 (429216.)

8865. "Radio receiving sets." General Electric Co., Ltd., and N. R. Bligh. March 21st, 1934. (429217.)

8866. "Electric-arc convertors." E. Marx. March 21st, 1933. (Cognate application 8867/34.) (429060.)

10886. "Electrical coupling plugs." J. A. Crabtree. April 11th, 1934. (429219.)

12174. "Television apparatus." General Electric Co., Ltd., and L. C. Jesty. April 23rd, 1934. (429221.)

13487. "Automatic or semi-automatic telephone or like systems." Standard Telephones & Cables, Ltd., E. P. G. Wright, G. C. Hartley and F. B. Bray. November 24th, 1933. (Divided out of 32849/33.) (429130.)

13623. "Electric oil switches." Schiele & Bruchsaler-Industriewerke Akt.-Ges. and J. A. Crabtree & Co., Ltd. May 5th, 1933. (429063.)

15427. "Acoustically controlled alarm installations." Siemens & Halske Akt.-Ges. May 23rd, 1933. (428973.)

15859. "Alternating-current electric motors." Dental Manufacturing Co., Ltd., and W. G. Lee. May 28th, 1934. (428976.)

17146. "Electric signalling devices." British Thomson-Houston Co., Ltd. June 9th, 1933. (428978.)

18442. "Automatic electric circuit-breakers." Schiele & Bruchsaler-Industriewerke Akt.-Ges. and J. A. Crabtree & Co., Ltd. June 22nd, 1933. (429071.)

18443. "Automatic electric circuit-breakers." Schiele & Bruchsaler-Industriewerke Akt.-Ges. and J. A. Crabtree & Co., Ltd. June 22nd, 1933. (429072.)

19136. "Thermionic valves and control-circuit arrangements therefor." Telefunken Ges. für Drahtlose Telegraphie. June 29th, 1933. (429230.)

19879. "Electric tele-indicating devices." Schneider & Cie. July 29th, 1933. (428899.)

20264. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 7th, 1933. (429075.)

22883. "Thermionic-valve caps and holders." Naamlooze Venncotschap Philips' Gloeilampenfabrieken. March 1st, 1934. (428903.)

23691. "Regulating arrangement for grid-controlled electric discharge vessels." Siemens-Schuckertwerke Akt.-Ges. November 9th, 1933. (429140.)

24674. "Gas or vapour-filled discharge rectifiers." Telefunken Ges. für Drahtlose Telegraphie. August 29th, 1933. (429142.)

25344. "Thermionic generators for producing high-frequency and ultra high-frequency oscillations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 6th, 1933. (429146.)

25572. "Luminous electric-discharge tubes." General Electric Co., Ltd. September 21st, 1933. (Addition to 414620.) (428996.)

25759. "Luminous electric signs." A. Wertheimer. September 7th, 1934. (Convention date not granted.) (429237.)

25996. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 3rd, 1933. (429148.)

26210. "Indirectly heated cathodes for electric-discharge tubes." Vereinigte Gluhlampen und Electricitäts Akt.-Ges. September 26th, 1933. (428997.)

27404. "Electric resistances and the manufacture thereof." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 4th, 1933. (429082.)

29277. "Device and method of controlling high-frequency currents." Radio Corporation of America. October 23rd, 1933. (428911.)

29493. "Signal-operated visual indicators for use in wireless-navigation-aiding systems." Telefunken Ges. für Drahtlose Telegraphie. October 13th, 1933. (429001.)

31913. "Apparatus for the protection of electrical machines." Siemens-Schuckertwerke Akt.-Ges. November 6th, 1933. (429003.)

33050. "Lighting systems." British Thomson-Houston Co., Ltd. November 18th, 1933. (429158.)

33754. "Amplifiers for photo-electric currents." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. December 23rd, 1933. (428919.)

36675. "Automatic electric-circuit breakers of the enclosed type." Felten & Guilleaume Carlswerk Akt.-Ges. December 27th, 1933. (429246.)

36676. "Protective circuit-breaker arrangements." Felten & Guilleaume Carlswerk Akt.-Ges. December 29th, 1933. (428923.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 12th:—

Concentra (lettering and design). No. 559671. Class 8. Wireless telephone and telegraphic apparatus.—Alfred Cohnreich, 157, High Road, Tottenham, N.

Livaklene. No. 558719. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—The Liverpool Electric Cable Co., Ltd., 7, Playhouse Yard, Golden Lane, E.C.1.

Livatint. No. 558720. Class 8. Electric flexibles and cables.—The Liverpool Electric Cable Co., Ltd.

Megaphos (lettering and design). No. 558479. Class 15. Reflectors, lamp shades, globes, glasses and like articles, all for use in connection with lighting, and all made of glass.—Megaphos Gesellschaft Leopold Weinstein, Vienna, Austria. (British representatives: J. E. Evans-Jackson & Co., 57-60, Holborn Viaduct, E.C.1.)

Pyranit. No. 557055. Class 16. Porcelain and earthenware.—Robert Bosch Gesellschaft, Stuttgart, Germany. (British representatives: W. P. Thompson & Co., 12, Church Street, Liverpool.)

Beacon. No. 559132. Class 50. Articles moulded from synthetic resin or casein or materials similar thereto.—Smith & Davis, Ltd., Beacon Works, Hampton Street, Birmingham.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Majestic Cinema (2,500 seats); Caledonian Theatres, Ltd.

Alderley Edge.—Telephone exchange for H.M. Office of Works, King Charles Street, London, S.W.

Ashford (KENT).—Cycle factory, Beaver Road; U.D.C. Buildings, Highways and Town Planning Committee.

Ashington (NORTHUMBERLAND).—Alterations and additions to Wallaw Cinema; G. Towers, builder, Union Street, Blyth.

Auchinleck (AYRSHIRE).—Houses (148); Wm. Reid, county architect, 14, Wellington Square, Ayr.

Aylesbury.—Reconstruction of Pavilion Cinema; R. Cromie, architect, Edgware Road, London, W.

Berkshire.—Extensions to County Girls' School, Osborne Road, Windsor, for County E.C.

Berwickshire.—Public high school, Eyemouth (electrical work), for County E.C.; Reid & Forbes, architects, 17, Great Stuart Street, Edinburgh.

Bilston.—Senior boys' school and extension to boys' central school and gymnasium; Joynson Bros., architects, Butcroft, Darlaston.

Birmingham.—Factory, Whittall Street; Percy Cox, Ltd., builders, Grove Lane. Rebuilding, Alexandra Theatre, John Bright Street; Wilfrid Robbins, Ltd., constructional engineers, Great Bridge, Staffordshire.

Blackburn.—Two schools, Shorrock Lane (£26,000), and bungalows, Longshaw Housing Estate; borough engineer.

Blackpool.—Houses (70), St. Walburgas Road; J. Gregson & Son. Bakery, near Preston New Road, for Blackpool Co-operative Society, Ltd., Sheppard Street; John Lucas & Sons (Builders), Ltd., 26, Eccleston Street, Prescot. Exhibition hall; borough engineer.

Bognor Regis.—Cinema (1,202 seats); Waterloo Square, Odeon Theatres, Ltd.

Boston.—Houses (260); borough surveyor.

Burgess Hill.—Telephone exchange, Mill Road, for H.M. Office of Works, King Charles Street, London, S.W.

Cardiff.—Business premises and block of shops, Wharton Street, for James Howell & Co., Ltd.; F. Thomas & Sons, Ltd., builders, Pearl Street. Nurses' training school, Llandough Hospital; city engineer.

Carlisle.—Houses, Currock Estate and Norfolk Road; J. Laing & Son, Ltd. Houses (96), Raffles Estate (£27,336); J. & R. Bell, Ltd.

Catterick Camp.—Houses (70), Walkerville Estate; F. Shepherd & Sons, builders.

Dagenham.—Houses (89), for London C.C.

Darfield.—Houses (40); William Johnson & Sons, builders, Wombwell.

Darlington.—Houses (106); borough surveyor.

Dartford.—Houses, Darenth and Swanley Junction; R.D.C. surveyor.

Denham (ETON).—Film studios, &c., for the London Film Production Co.

Derby.—Telephone exchange and repeater station for H.M. Office of Works, King Charles Street, London, S.W.

Dumfries.—Houses (30), Welldale; Paisley, Skilling & Co., builders.

Dundee.—Cinema, Strathmartine Road; Messrs. Pennycock.

Durham.—Schools, Pittington and Sherburn; T. B. Tilley, director of education.

East Sussex.—Central school, Heathfield; director of education, Lewes. Secondary school (£32,014), Hove, for County E.C.; E. D. Winn & Co., builders, Knightsbridge, London, S.W.

Eccles.—Houses, Regent Street and Haddon Estate (£25,549); F. E. Gill & Sons, Trafford Park.

Edinburgh.—Library, Corstorphine; E. J. MacRae, city architect.

Fareham.—Houses (27); Plans and Town Planning Committee.

Flintshire.—Alteration and additions to Old Rhyl Emanuel Council School; R. G. Whitley, county architect, County Buildings, Mold.

Flockton (YORKSHIRE).—Houses (23), Parkside; Mr. Barr, U.D.C. surveyor.

Folkestone.—Houses (69); Building and Public Works Construction Co., Ltd., builders, Swindon.

Gainsborough.—Post office; H.M. Office of Works, London, S.W.1.

Gateshead-on-Tyne.—Swimming baths (£35,000); F. H. Patterson, borough engineer, Municipal Buildings.

Glasgow.—Extensions to Crookston Institution; city engineer.

Golcar.—Houses (20), Rufford Street; U.D.C. surveyor.

Grangemouth.—Houses, Newhouse Road and Abbott's Road; Grangemouth Co-operative Building Society.

Guisborough.—Houses (30), Parkside; R. H. Kilburn, surveyor, Council Chambers.

Halesowen.—Houses (24), Narrow Lane; W. J. Tolley, builder.

Harrow.—Houses (110), Glebe and Berridge Estates; Council's surveyor. Houses (382), Earlsmead Estate, South Harrow; P. H. Edwards, 237, Golder's Green Road, N.W.11.

Hastings.—School, Red Lake, Ore, for E.C. Extensions to printing works, Sinnock Square: F. Gordon Watford, architect.

Havant.—Houses (50), Victoria Road, Emsworth; U.D.C. surveyor. Houses, garages, &c. (99); Building and Town Planning Committee.

Helsby.—Houses (46), Alvaney Road site; L. Swires, builder, Southlands, Helsby, near Warrington. Houses (130), Helsby Housing Estate, near Warrington; Clare & Ryder, builders, 36, Greenway Road, Runcorn.

Hemsworth (YORKSHIRE).—Houses (42); R.D.C. surveyor.

Inverness.—Shops and stores for the Inverness Co-operative Society; the manager.

Iver Heath.—Film studios for the British National Pictures (£250,000); Henry Boot & Co., Ltd.

Kidderminster.—Block of shops and flats, Mill Street, for the Ideal Benefit Society, Pitmaston, Birmingham, 13; R. O. Warder, society's architect. Three-storey building, Oxford Street, for Kidderminster Industrial Co-operative Society, Ltd., Oxford Street; Lacy Bros., Ltd., builders, Adam Street.

Lanark.—Houses (92), Larkhall, Chapelhall and Carnwath; P. C. Smith, town planning engineer, 13, Clysdale Street, Hamilton.

Lancashire.—Boys' senior council school near Glebelands Road, Prestwich, for C.C.; J. Hartley, builder, Cobden Street, Chadderton, Oldham.

Leicester.—Extensions to works for Partridge Wilson & Co., Ltd., Davenset Works, Evington Valley Road; Henry Herbert & Sons, builders, Millstone Lane.

London.—(GREENWICH).—Town Hall, London Street and Royal Hill; borough surveyor.

Luton.—Houses (52), Bristol Road Estate; borough engineer. Extensions (£69,000), for Electrolux, Ltd.; J. C. Hafner, works manager.

Macclesfield.—Houses (38), Field Bank Estate, Chester Road; W. Brough, builder, St. Andrews Road.

Malden.—Schools (240 places), Worcester Park, for R.C. Managers; priest in charge.

Malmesbury.—Aerodrome, Bell Farm (500 acres), for R.A.F.

Marple.—Houses (108), Marple Hill Estate, Rose Hill; J. Williams, builder, 9, Greenwalk, Gatley, Cheshire.

Middlesex.—Elementary School, Collier Drive, Stag Lane, Harrow, for County E.C.

Morecambe.—Extensions to Queen Victoria Hospital; Committee.

Newburn-on-Tyne.—Houses, West Denton Estate; R. Burke, architect, 12, Grey Street, Newcastle-on-Tyne.

Newport (I.O.W.).—Milk factory, Westminster Lane; Phelps & Steadman, architects.

Northern Ireland.—(BALLYMENA).—Public elementary school, Groggan, near Randalstown; J. Scott, architect, 11, Fountain Street, Belfast. (LURGAN).—Houses (33), Garland Avenue, for U.D.C.

Norton.—Houses (34); R.D.C. surveyor.

Oldbury.—Swimming and slipper baths, Vicarage Lane (£20,000); U.D.C. surveyor.

Oldham.—Maternity block, Municipal Hospital; borough engineer.

Oxford.—Regal Cinema, George Street; Oxfordshire and Berkshire Cinemas, Ltd. Extensions to Oriel College, Oriel Street; Provost.

Perth.—Houses (80), north of Florence Place; Perth Housing Association, 75, George Street. Additions and extensions to Corporation Baths, Dunkeld Road (£22,000); Thos. M'Laren, burgh surveyor, City Chambers.

Pinxton.—Church for the Rev. F. G. Reeves and Parochial Council; A. T. Jackson, architect, 5, The Quadrant, Coventry.

Plymouth.—Houses and flats, Moor Farm Estate; city engineer. Houses (58), Trefusia Estate, Laira; Cohen & Fredman.

Portsmouth.—Houses (308), Cosham (£102,519); H. E. Pitt, Ltd., Sunderland. Houses (26), Highbury Grove; G. & W. Mitchell.

Reading.—Houses (191), Woodcote Road, for F. M. Gant.

St. Andrews (FIFESHIRE).—Houses (120), Lamond Drive; Walker & Pride, architects, Church Square, St. Andrews.

Skipton.—Post office and telegraph exchange, Newmarket Street; H.M. Office of Works, London, S.W.1.

Springhead (LANCASHIRE).—Houses (30); U.D.C. surveyor.

Stockport.—Houses (42), Station Estate, Tenby Road, Cheadle Heath; R. W. Willan, builder, Station Approach, Brooklands, Sale, Cheshire.

Stockton-on-Tees.—Houses (22); borough surveyor.

Stranraer.—Houses (154), Dick's Hill; Jos. Mercer, burgh surveyor, Municipal Buildings.

Strood (KENT).—Houses (22), A. T. Vincent & Son, builders, Sturdee Avenue, Gillingham.

Tottenham.—Factory, Brantwood Road; Hyman Lazarus, Ltd. Flats (363), Ladysmith Road; G. E. Jackson, agent, Waverley Syndicate. Extensions to factory, Willoughby Lane; Jameson's Chocolates, Ltd.

Urmston.—Houses (100), Newcroft Hall Estate, near Stretford Road; Longworth & Taylor, Ltd., builders.

Wakefield.—Houses (66), Peacock Farm Estate; George Crook & Sons, Ltd. Cinema, Whinny Moor Road; Savoy Picture House Co., Huddersfield.

Walsall.—Houses, near Wolverhampton Road, Hedgehill Estates, builders, Washwood Heath Road, Ward End, Birmingham.

Wantage.—Houses (52); Building & Public Works Construction Co., Ltd., builders, Swindon.

Wenlock (SHROPSHIRE).—Houses (32), Madeley Road, Ironbridge; H. T. Hickman, surveyor, 1, Market Street, Wellington.

West Riding.—Extensions to Rawmarsh senior schools (£15,000); education architect, Wakefield.

West Sussex.—Schools, Fishergate and Victoria Road, Shoreham; county architect, Chichester.

Whaley Bridge.—Houses (48), Orchard Field Estate; Z. & W. Wade, builders, Trimmingham Quarries, Halifax.

Whickham-on-Tyne.—Houses (34); Thomas Fenbow, architect, Council Offices.

Wood Green.—Town Hall (£35,000); borough surveyor.

Worcester.—Houses (300), Talladine Road; William Ransom, city engineer.

Worksop.—Houses (50), Harworth; R.D.C. surveyor.